# Better Crops with PLANT FOOD

March 1942 10 Cents

The Pocket Book of Agriculture

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**How to Determine Fertilizer Needs of Soils**

**THE AMERICAN POTASH INSTITUTE**
**1155 16TH STREET, N. W. WASHINGTON, D. C.**

# Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

*Editorial Office:* 1155 16th Street, N. W., Washington, D. C.

VOLUME XXVI NUMBER 3

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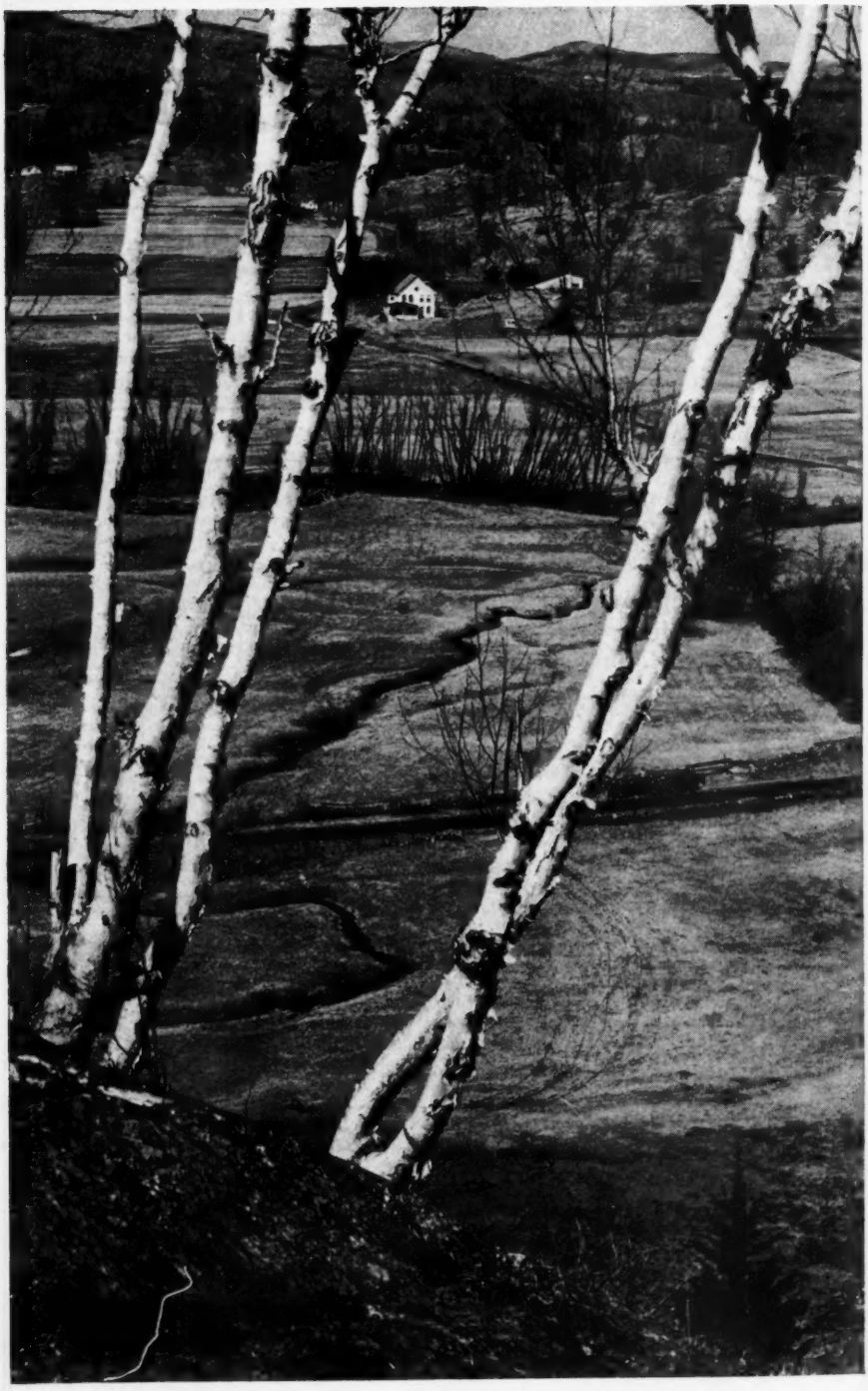

MARCH LANDSCAPES HOLD PROMISE OF THE BEAUTY TO COME.

Better Crops with PLANT FOOD

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Vol. XXVI WASHINGTON, D. C., MARCH 1942 No. 3

*Civilians need a new word . .*

# "Civ-ense"

Jeff McDermid

WHAT an awe-inspiring feeling it is to create a brand new word, such as the above title discloses! Look at it again! You're in at the "delivery" of it and should appreciate what that privilege signifies. And there are no extra admission charges either.

What in tarnation does it mean, anyway? Well, this commanding word will soon be accepted in our common parlance along with "jeep" and "blitz" and "axis," which you understand. Think a minute—it stands for Civilian Defense, being a short-cut through three or four useless syllables to reach the heart of home and community safeguards.

"Civ-ense!" Get it? Sure you do, but no plaudits, please; I'm just a humble citizen like yourself and ask no public praise for a modest moniker. "Civ-ense"—it has a hyphen now, but I'll operate on it shortly and remove the ligament, after the English-speaking world adopts it. As "Civense" it will stand thereafter.

Every loyal Yankee secretly yearns to be of sterling service to his beleaguered bailiwick, and I am no exception. For several weeks since they took the ice out of isolation over in Hawaii, this scribe has been pondering how a maturing fellow in the fourth draft category could emerge as a pluperfect patriot without learning to knit or go stumbling around in the home guards.

Being no fan dancer, blues singer, or teacher of terpsichore, and having no experience in the movies, I did not thrust myself upon the attention of Washington organizers. But I have haunted the county office of Civense

which is lodged alongside the tire-rationing board—without having any designs upon the latter, however. I have scanned their occupation lists assiduously for signs of some echoing talent lying dormant within my noble spirit, some rare and inspiring motif perhaps, which yours truly might bring forth to stem the tide of local confusion and blast the daylights out of the prevailing complacency.

All my deliberations up there in that rickety Civense office over Cal Smither's harness shop I shall reserve for later mention. Suffice it to say, my goal is attained in one mental leap in the dark, and in coining another new medium of verbal exchange the same calm satisfaction steals over me as Francis Scott Key or General Sherman must have felt when they burst out with the Star Spangled Banner and War Is Hell.

I MAINTAIN that anyone who can shear off a lot of Webster's red tape and thus keep step linguistically with modern streamlined campaigns is doing yeoman service. We Americans think we are hustlers, but we "ain't seen nothin' yet" to match the swift, clipped, abbreviated action ahead of us. Using my new word is just a beginning.

To be cluttered up in our communication with scores of useless letters and syllables would be as conducive to our defeat as keeping those old civil war cannons on our humble public squares for anti-aircraft flak.

Having stolen a base on the enemy in this deft manner, I shall return to my watchful position in the drafty office over Cal Smither's place, noting some of the painful attempts of my worthy but misguided compatriots to justify their idle existence here, so far from Luzon or Port Darwin.

Heading the list of desirable jobs in the Civense Corps is the post of Air Raid Warden. I was rather slow in making up my mind over its duties and my own qualifications, so I found last week to my chagrin that my neighbor, Abel Gooch, had appointed himself to that office for our residential block, No. 77 in Ward 25, where Abel has retired after a noteworthy career in the fire insurance business.

ABEL comes in better qualified than many of us. He has inspected all the houses from cellar to attic and knows all the firemen and garbage collectors personally. The only things Abel lacks are tact and reticence, which are not qualities likely to be fostered by the insurance profession, but which, peradventure, seem also not indispensable for a persistent air raid alarmist. The very fact that we are well removed from the coast is no reason why such a capable gent as Abel should not make the most of his duty.

In explaining to us his undertaking, Abel remarked that he had been a game warden and a church warden earlier in life, but that the grinding routine of insurance soliciting sadly interfered with his getting beyond the amateur stage with either. At last, he said, in his declining years he felt free to go to town with the warden business, and being used to keeping his eye glued aloft for chimney fires and thunderstorms, it would be no trick for him to scan the skies day and night, if need be, in the interest of his neighbors under siege or apt to be.

I can't exactly say whether Mrs. Roosevelt or F. LaGuardia told Abel to start regular practicing, but ever since he signed the roster with our Civense Board he has devoted eighteen hours daily to limbering up for the first bomber attack. Confidentially, Abel has become somewhat of a public enemy thereby, but our neighborhood is tolerant and fully aware that this is going to be a tough war and Abel isn't the worst phase of it.

To begin with, Abel got himself a complete outfit copied out of the British code, including ropes tied around his waist, several flashlights, a referee's whistle, a first-aid kit, a gas mask, and a pulmotor. Every night Abel goes the rounds covering our block faithfully

—almost too faithfully at this stage—drawing a cart with part of his clutter behind him.

One night the Enoch Millers had a bridge whist festival, and just as they were getting set to hand around the prizes to those who had successfully doubled and redoubled, Abel let go with a shrill whistle, rang the doorbell, walked in and shouted, "Blackout for half an hour!" He went down-stairs and unscrewed the fuses, besides.

Two nights later Val Upson was sparking Sis Jones along about midnight in a quiet way, when Abel barged in with a raucous blast and jerked his flashlight on them, saying, "Blackout's over. All's clear. Lights on!" Poor Sis fainted and Abel got to use the pulmotor.

Personally, I had no grievance against him until he started practicing the school kids in seeking raid shelters. He led a passel of boys down into our basement and left them in Mother's preserve cellar, with consequences which were natural under the circumstances. If their parents think they can sue me for gastronomic damages to their youngsters, I'll sic them onto OCD or Abel himself—whichever is the more vulnerable. Anyhow I suspect we'll feel safer this summer having a night watchman prowling around without getting socked for it extra at tax time.

We have other patrioteers too. Not to be outshone by Abel Gooch, we have for our local Information Specialist on Civense no other than Miranda Hix. By all odds Miss Hix is born to the job voluntarily assigned to her. A retired schoolma'am with a talent for assembling both intimate and international data, Miranda brings a zealous ardor to her rather thankless duty.

She spends many laborious hours poring over tomes and tracts in the Carnegie free library, and boils forth with sparks of erudition like one of the canny Scot's own Bessemer converters. Here again I confess to being sluggish myself in not seizing this job before Miranda got her mitts on it. However, it may be best in the long run, as folks are more apt to believe what she says because her imagination and textual embellishment are sadly inferior to mine, after all the moons I have practiced on you. Anyhow, she makes the circuit once a week and litters up our reading tables with everything from Japanese Shinto and samurai to synthetic rubber and sugarless recipes.

I DOUBT if Claude Wickard's best bureau of repetitious releases and explanatory speeches can hope to perform as well with as little recompense as Miranda—but it must be said in defense of the department aforesaid that Miss Hix is not obliged to spend any precious time hanging around waiting for diverse O. K. signatures. She alone is responsible and she scorns to pass the buck to the government for any overstatements or inaccuracies. Moreover, her output reaches the ultimate consumer direct without having to run the hard-boiled gauntlet of newspaper desks.

Noting how successful Miranda is in her public interference, I studied that list again and had about decided to try out for Recreation Regulator. Here again I was frustrated and nudged out by a former Y. M. C. A. athletic coach, Nobby Nolan. Nobby argued the Civ-

(*Continued on page* 46)

# *More Legumes for Ontario* Mean *More Cheese for Britain*

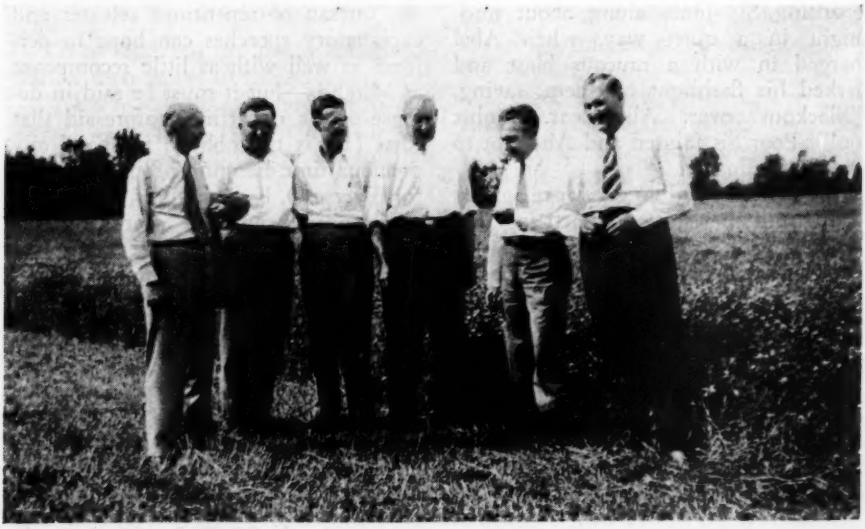
*By W. B. George and B. L. Young*

Kemptville Agricultural School, Kemptville, Ontario, Canada

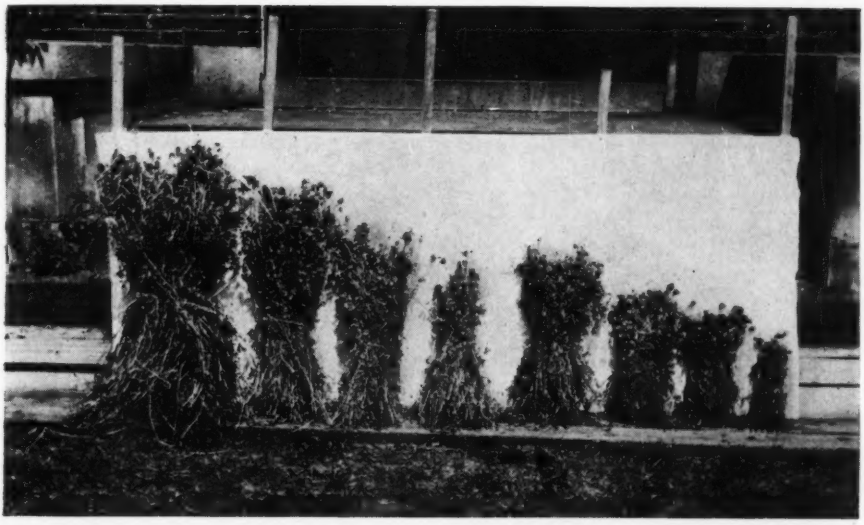
WAR has thrown the spotlight on eastern Ontario because cheese, and more cheese, is one of the most urgent needs in sustaining the fighting forces and civilian population of Britain, and this section of Canada supplies a great proportion of the exported cheese.

The production of cheddar cheese has long been the mainstay of eastern Ontario agriculture. Sixty-five per cent of Ontario's cheese comes from the counties which lie between the Ottawa River on the north and the St. Lawrence River, the great highway to the sea, on the south. There are more than 500 cheese factories in this area.

As a natural sequence to this demand for cheese and other dairy products and due to the fact that more than 90 per cent of the cheese is produced during the period from May 1 to November 1, dairymen have become interested in the improvement of pastures and legume hay crops. Since many good dairymen had reported increasing dif-



**Examining the plots on the Newman farm are Dr. J. W. Turrentine, President of the American Potash Institute; H. G. MacLeod, Agricultural Representative of the Grenville Company; B. L. Young, Fellow, Kemptville Agricultural School; Dr. L. H. Newman, owner; Dr. Taylor, Agricultural Attache, U. S. Consulate, Ottawa; and M. C. McPhail, Principal, Kemptville Agricultural School.**

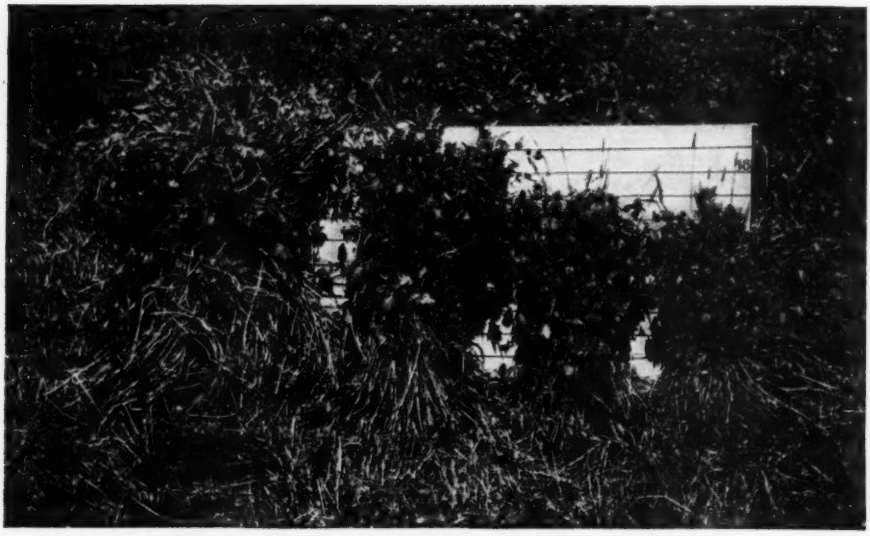


**One square yard from plots 1, 2, 3, and 4; first cutting (left) and second cutting (right).**

ficulty in securing catches of clover and retaining this seeding for future pasture, investigation of the problem began three years ago.

The first permanent fertility field chosen for investigation was on the farm of L. H. Newman, Merrickville, Ontario, in the heart of a dairy section. The field was 12 acres in size, the soil of a sandy loam type representative of considerable area in eastern Ontario, fairly well drained naturally, low in organic matter, and with a pH of 6.5. Subsequent soil tests by the Neubauer method revealed that both phosphate and potash were at very low levels. A 5-year rotation was in practice, namely, corn, oats, legume hay, mixed hay, and pasture. The entire field received an applicaton of 12

**Samples of second cutting from plots 1, 2, 3, and 4; August 1941.**

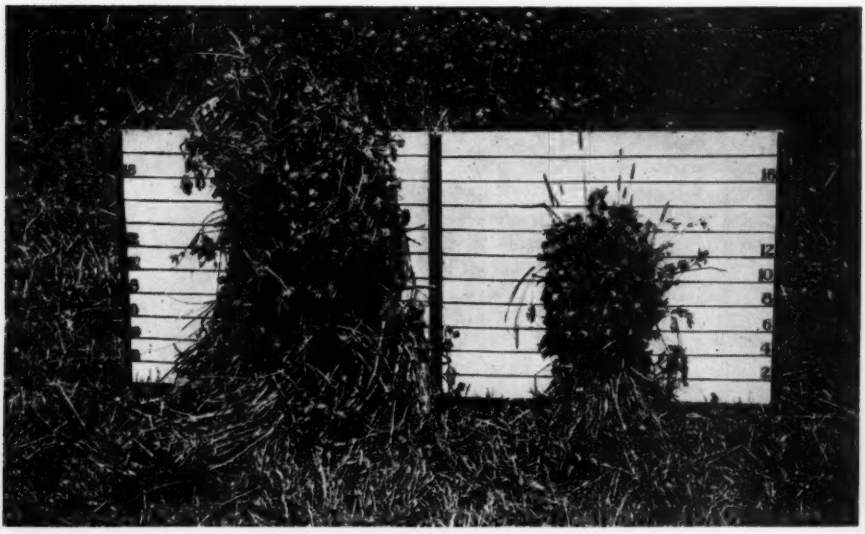


**Close-up of first cutting from plots 1, 2, 3, and 4; June 1941.**

tons of manure per acre in the spring of 1939 previous to planting corn.

This field was divided into four areas of three acres each with different fertility treatments applied to each area. Plot 1 received an application of 500 pounds of superphospate and 350 pounds of muriate of potash previous to planting corn in the spring of 1939. An additional application of 250 pounds of 2-12-10 was given at planting time. This plot received similar treatments in 1940 and 1941 with the exception that the muriate of potash was reduced to 300 pounds in 1940 and 250 pounds in 1941 due to an increase in the potash levels.

Plot 2 has received 250 pounds of 2-12-10 each year in the rotation, while plot 3 received only one such applica-



**Samples of first cutting from plots 1 and 4.**

tion on the corn crop, the customary fertilizer practice in the neighborhood being the application of fertilizer once during the rotation. Plot 4 was left as a check plot but received the same amount of manure as all other plots. The yields of corn and the oat crop which followed were not high, neither were there spectacular differences in yields as between the various plots.

CROP YIELDS PER ACRE—CORN 1939 AND OATS 1940

| Crop | Plot 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Corn (tons) ... | 18.01 | 15.2 | 15.2 | 14.65 |
| Oats (bushels) . | 48.0 | 38.5 | 38.1 | 32.8 |

There were, however, obvious differences in the quality of the oats, with plot 1 weighing 33 pounds per measured bushel and 16.2 per cent small oats, while plot 4 weighed 24 pounds per measured bushel and 32.3 per cent small oats.

Prior to the harvesting of the oat crop in 1940 it became clearly evident that the young clover plants were responding vigorously to the higher fertility treatments. While the plant population on plot 4 was satisfactory, the growth lacked vigor. On plot 1, however, the clover plants were so rank that the owner decided more value would be secured from feeding the oats in the sheaf. Parts of this plot were cut for hay, and the sheaves, which consisted largely of clover, were cured on tripods. Later in the fall, 12 head of young cattle were pastured on this area which provided valuable feed for at least 5 weeks without causing any injury to the new seeding.

The 1941 crop of legume hay provided the greatest surprise. From the time growth started in the spring, the differences between the various plots could be noticed. By May 20 plots 1 and 2 were thoroughly covered with a dense mass of red clover, alsike, and alfalfa, with timothy and orchard grass filling in any thin spots. In spite of an unusually dry season, these plots continued to thrive without any setback. At no time was growth vigorous on plots 3 and 4, and in early June, due to the prolonged drought, the crop practically ceased growing.

The first cutting of the plots was made on June 21 and the second cut-

(*Turn to page* 39)

**Pasturing plot 1 on the Newman farm, September 1941.**

# High-grade Fertilizers Are More Profitable

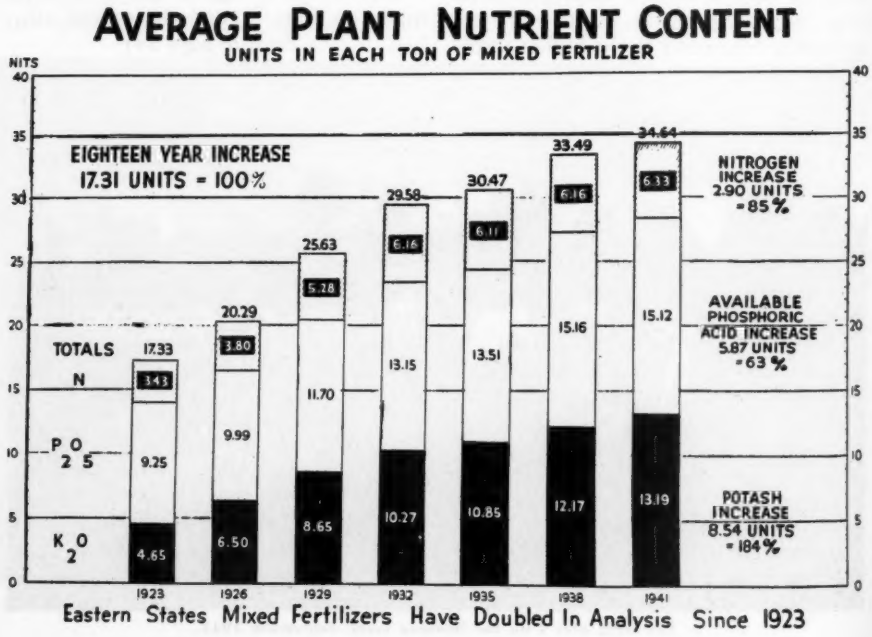
*By M. H. Lockwood*

Manager, Fertilizer Division, Eastern States Farmers' Exchange, Springfield, Massachusetts

EIGHTEEN years is a long time, yet not too long in which to accomplish something worth-while. We state this because it took us from 1923, when our average mixed fertilizer contained 17.33 units of plant nutrients, until 1941 to double the average analysis of our mixed fertilizers. Actually our program of high analysis mixtures of the 40-unit type began in 1925, although there had been a definite trend upward before that year. Right now, however, most of us are interested in those practical things which we can do at once to contribute toward our nation's Victory Program.

The possibilities along this line in higher analysis fertilizers lie principally in increasing 15- and 20-unit mixtures to 20- and 25-unit grades. The savings thus made will be largely in the greater efficiency of package use, in manufacturing margins, and in distribution costs such as railroad freight. Users naturally question whether such higher analysis fertilizers are as satisfactory in terms of crop results. The answer is yes, as indicated by yields on thousands of farms. Equally satisfactory yields have proven the agronomic soundness of higher analysis fertilizers year after year.

If there were available plentiful sup-




Eastern States Mixed Fertilizers Have Doubled In Analysis Since 1923

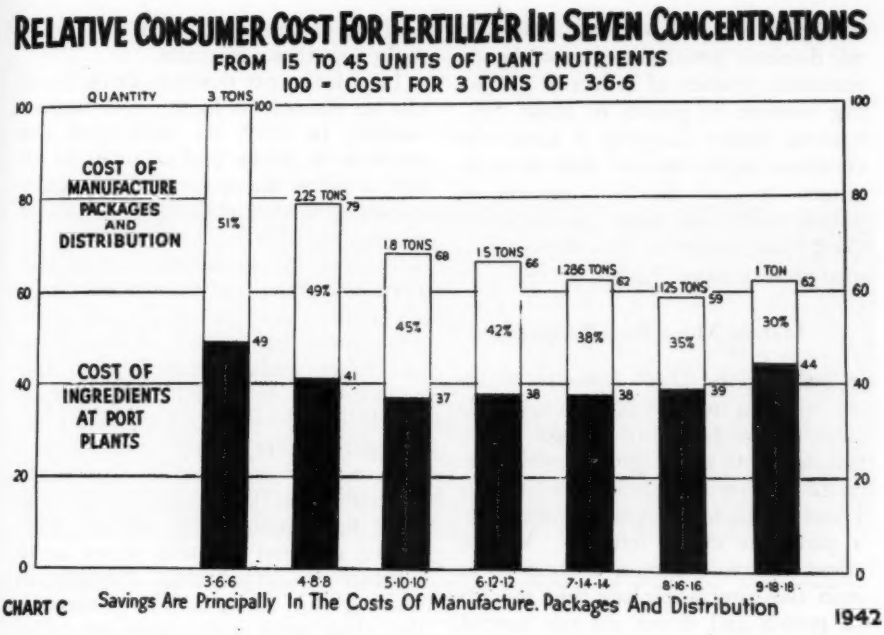



CHART C Savings Are Principally In The Costs Of Manufacture. Packages And Distribution 1942

plies of high analysis materials, we might well go further in our present recommendation. The fact remains, however, that in both the phosphates and the nitrogen carriers, our supplies of high analysis materials are quite definitely limited. The changes we can make right now in our mixed fertilizer concentration are confined to those made practical by the gradual increase in analysis of the ingredients we use in making up some of the grades of mixed fertilizer of which our national tonnage is heavy.

The survey of fertilizer distribution for the year ending June 30, 1939, indicated that of the 12 leading grades in ton volume, only three had a plant nutrient content of 20 units. This indicates that we have a lot of room for improvement. With the present heavy demand on our transportation facilities and the urgency for conservation of packages and farm labor, we can see added reasons for doing without delay everything we can to take up the slack in any of our present customs. One of the ways we can do this in fertilizers is to increase 15- and 20-unit mixtures about five units in concentration. Such an increase would result in substantial savings in cost to the fertilizer user, in packages, manufacturing costs, and in transportation.

The relative savings in cost for increases in concentration are illustrated in Chart C, which shows that in a 1-2-2 ratio there are substantial savings in increasing the concentration from 15 units as in the 3-6-6 grade to 20 or 25 units as shown in the 4-8-8 and 5-10-10 grades.

The room with which to make these changes has been developed largely during the past 15 or 20 years by increases in the analysis of many fertilizer materials commonly used. In ordinary analysis superphosphate, for instance, 18% and 20% material are commonly produced now where 10 or 15 years ago the analysis of this material was usually two or more units lower. There are numerous other parallels that could be drawn, but we shall mention only one. In muriate of potash, for instance, 10 years or more ago, most of us were using a grade of this material analyzing 48 to 50% potash, but for several years now, the industry has been able to secure muriate of potash analyzing 60%

or higher. In fact, we have, today, in our domestic potash distribution the uneconomic practice of refineries rediluting muriate of potash to make 50% material before shipping it across the continent largely because there is an insistent demand for 50% muriate of potash which the trade for so many years used when it was the highest analysis available.

### Habits Must Be Changed

Probably the chief difficulty we in the fertilizer industry have to overcome is the mental hazard of "figures." It is human for us all to like something because we are accustomed to it. We become used to the grade numerals of a particular mixed fertilizer. We become used to a certain analysis of an item like superphosphate and muriate of potash and if we are not careful, we find ourselves in the awkward position of leaving our fertilizer grades too much like they used to be without taking into consideration the sound changes that could be made in them if we took advantage of the increases in analysis of the ingredients that go to make up those mixtures.

In order to get down to cases, I will cite an illustration in my own organization. In 1939, we resurveyed our position on grades and ratios in an effort to follow the suggestions of agronomists who were making a new set of recommendations. In this survey, we discovered that during the preceding 11 years, one of our leading ordinary analysis grades, the 4-8-8, had become somewhat out-of-date because of the advent of higher analysis ingredients. And what did we do? We replaced it with a 5-10-10 which, as Chart A shows, brought its plant nutrients to consumers at a cost well under the level at which we could have furnished them the same plant food in the 4-8-8 mixture.

The question naturally arises as to whether we experienced difficulty in making this change. The answer is that there were many questions asked and there was quite a lot of explaining to do during the first season or two, but in spite of many users having been thoroughly accustomed to the 4-8-8, the change was made and made abruptly.

(*Turn to page* 32)

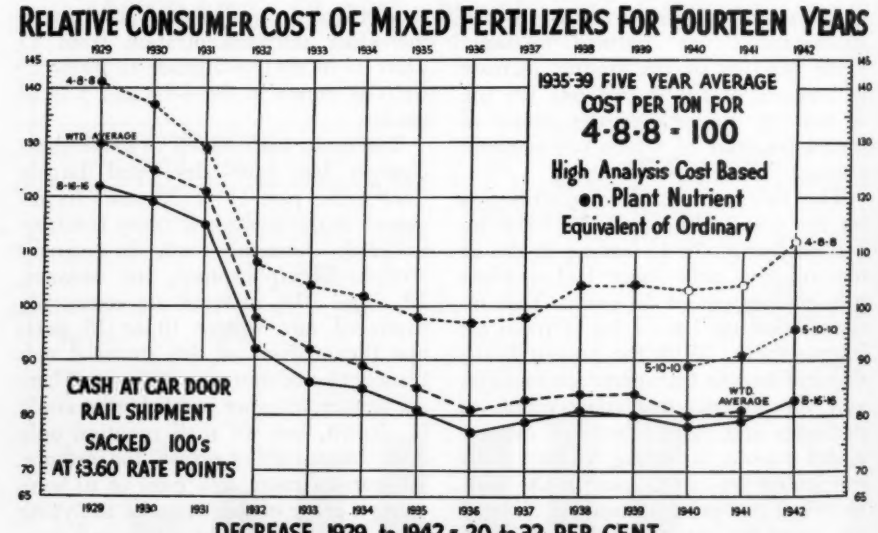
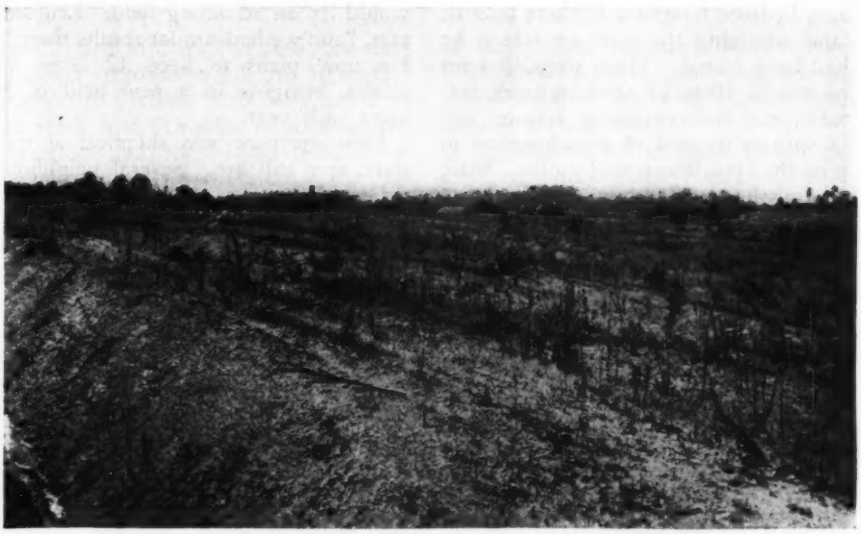

RELATIVE CONSUMER COST OF MIXED FERTILIZERS FOR FOURTEEN YEARS
1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942
145 140 130 120 110 100 90 80 70 65
4-8-8
WTD AVERAGE
8-16-16
1935-39 FIVE YEAR AVERAGE COST PER TON FOR 4-8-8 = 100
High Analysis Cost Based on Plant Nutrient Equivalent of Ordinary
4-8-8
5-10-10
5-10-10
WTD AVERAGE
8-16-16
CASH AT CAR DOOR RAIL SHIPMENT SACKED 100's AT $3.60 RATE POINTS
DECREASE 1929 to 1942 = 20 to 32 PER CENT
In Ordinary Analysis Mixtures Increases of Five Units in Concentration Substantially Decrease Relative Costs as Indicated by the 4-8-8 and 5-10-10 Since 1939
1942

CHART A



**Scenes like this are commonplace in No-Pone Valley in the acid soil area of East Tennessee. Erosion damage is everywhere in evidence—bushes, briers, bitterweed, and "Poor Joe" predominate.**

# The Hope of No-Pone Valley

*By Joe A. Elliott*

Agricultural Extension Service, Knoxville, Tennessee

SOILS in No-Pone Valley are notoriously poor. Crop yields are low and living is meager. Idle land and abandoned homes are commonplace.

The very name is significant. It originated during the War Between the States when soldiers quartered there claimed they had to leave the valley and go into the limestone valleys to find sufficient corn to make bread. Hence the name "No-Pone," because natives had no corn for pone. More recently the area has been facetiously called by such names as "New Egypt" and "Land of Canaan." One section is sometimes referred to as "Kettle Hollow" because so much of the little corn that is produced is processed in copper kettles.

No-Pone is one of several valleys of acid shale soils which parallel the dolomitic limestone ridges of the Appalachian region. These shale veins start at the alluvial plains of Georgia and run in a northeasterly direction into Pennsylvania. They constitute some 15 per cent of the farm lands of east Tennessee and a lesser percentage in west Georgia, east Kentucky and southwest Virginia.

During recent years a few farmers have learned to do a very creditable job of farming on acid shale soils with the aid of fertilizers. One of them is O. H. Ledford, a young farmer in Meigs County, Tennessee, and a kind of hero in No-Pone Valley.

Shortly after he married 10 years

ago, Ledford bought a 125-acre tract of land adjoining the farm on which he had been reared. There were 40 acres in woods, 10 to 12 acres in creek bottoms, and the remaining acreage was in various degrees of abandonment to pine thickets, briers, and gullies. Since hauling logs and driving a school bus brought in most of Ledford's income, little thought was given to farming except in the creek bottoms where grain was raised for the work stock.

would try an adjoining field," Ledford says, "and we had similar results there." He now plans to keep 12 acres in alfalfa, bringing in a new field of 3 acres each year.

Most everyone was skeptical at the start; few still are. Several neighbors ridiculed the idea of spending money for fertilizer and seed to be, as they said, "thrown away on that old shale soil." They even accused County Agent Shadow of driving out in the moon-

**The O. H. Ledford family on the porch of their recently completed modern residence. They have also added a livestock barn, poultry houses, and a milk house during the past few years.**

Ledford was having to buy hay so he asked County Agent W. A. Shadow if his creek bottoms wouldn't grow alfalfa. Shadow, who knew this land to be poorly drained, suggested they try a small acreage on the shale hillsides as an experiment. Land was prepared early; 2½ tons lime, 600 pounds 16% superphosphate, 50 pounds muriate of potash, and 50 pounds nitrate of soda per acre were applied; and seed was sown in August.

Results surprised the neighborhood. Land that was a barren waste the year before produced a good stand of alfalfa that yielded an average of 3½ tons hay per acre for 4 years. "We figured if this field would grow alfalfa we

light to check on results, saying that he was ashamed to be seen around. This was eight years ago. There are now 60 acres of alfalfa on 45 different farms within a range of 20 miles of Ledford's farm as a result of his demonstration.

Good results from alfalfa don't end with the hay, either. Ledford says that corn yields following alfalfa are at least doubled, and he regularly makes 50 to 60 bushels per acre to prove this statement. Average corn yield on shale soils would probably not be over 20 bushels per acre. And one farmer said, "Plenty of it won't average."

Soil experts with the Tennessee Extension Service have classified Ledford's

land as 3rd, 4th, and 5th class; 3rd class land is recommended for cropping every 5 to 6 years, 4th class every 7 to 10 years, and 5th class is unsuited for cropping and should be devoted to permanent pasture or forest land. To meet recommended land use, Ledford has worked out three rotations. In over-flow creek bottoms, he follows a 5-year rotation of 1 year in corn and 4 years in meadow; on the less steep shale hillsides he follows a 6-year rotation of alfalfa 4 years, corn and small grain the next 2 years; steep hillsides are in permanent pasture with a small acreage selected each year for corn and cotton so that land is not cropped more often than once in 10 years.

Ledford had a small herd of beef cattle when he started farming. To meet land payments, these had been sold down to one cow. When it was found that he could grow alfalfa, refinancing was arranged through the Farm Credit Administration and a few dairy cows added. The herd has been built to 27 at present.

Milk checks from the Chattanooga, Tennessee, Milk Producers Association average $250 a month. Egg sales from a flock of 300 Brown Leghorn hens return around $800 annually. Add to this several hundred dollars from strawberries and a small acreage of cotton and you have a substantial farm income for any valley.

A complete set of farm buildings, including a modern residence, milk house, livestock barn, and poultry houses, has been built. A much-used room in the new home is the storage pantry for canned goods. Even though there are three children, two boys and a girl, "It's mighty little food we buy at the grocery stores," Mrs. Ledford says.

### Ledford Showed the Way

Bill Runyan operates the farm of his father, J. F. Runyan, adjoining Ledford on the west. Bill returned to the farm 4 years ago after having traveled for a large dry goods company for 21 years. In discussing the return to farming, he said, "Obed Ledford showed us what this shale will do. It takes fertilizer though. I wouldn't plant a seed of any kind without fertilizing. But when you use fertilizer, you know what to expect."

Runyan's theory is that alfalfa, sericea, and other deep-rooted legumes add needed nitrogen and organic matter

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**The Ledford dairy herd of 27 cows. Milk checks average $250 monthly.**

**Mr. and Mrs. Caesar Pedroni with some of their Kenyon Easter Lilies, a variety now being produced along the Oregon coast.**

# Lilies for Easter

*By J. C. Burtner*

Agricultural Extension Service, Corvallis, Oregon

IF Americans enjoy their usual plentiful supply of Easter lilies in the next few years, it will be because a few pioneer American lily growers in widely scattered portions of the American Continent have nursed along an infant industry which has suddenly assumed outstanding importance.

In the past an estimated 28 million Easter lilies have been grown by American florists each year. The chief source of the bulbs used for forcing in greenhouses was Japan. Approximately $4,500,000 have been sent to Japan each year in return for these lily bulbs. That supply is now cut off, of course, for the duration of the war at least and possibly for a considerable period thereafter.

A partial American supply has been developed recently in the deep South and in the far West. In the South the Creole lilies have supplied a portion of the normal market. In the extreme West along the Pacific Coast, in fact within sound of the breakers, a promising lily industry is developing which may prove to be the chief source of stock in the future.

So far the output is not great, but with an exceedingly brisk demand, the available supply of stock will be increased as rapidly as possible. In 1940, 90 acres of lilies were grown in Oregon, but only about half of these were the Easter lily type. The acreage increased materially in 1941 and will expand just as rapidly as planting stock can be developed.

If a complete domestic supply is obtained, approximately 9,000 acres will

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# Legumes Are Essential to Sound Agriculture

*By A. F. Gustafson*
Cornell University, Ithaca, New York

LEGUMES deserve a large place in hay mixtures on dairy, general, and livestock farms. Moreover, legumes serve a useful purpose in green manure crop mixtures on vegetable, fruit, cotton, tobacco, and other cash crop farms. In general, legumes produce larger yields than nonlegumes and have a higher protein and mineral content, therefore, a higher feeding value for livestock. Legumes in green manure seedings are markedly beneficial to intensively grown crops.

A common requirement for popular crops is plentiful, inexpensive seed. Legume seed is less plentiful and ordinarily costs a little more per acre than the seed of nonleguminous crops. The current relatively high cost of the seed of leguminous crops should stimulate seed production in this country so that costs may be brought back to normal in a year or two. In spite of somewhat higher seed costs, however, legumes should be sown on large acreages because of their real value.

A number of things may be done to cut acre seed costs. Good farmers should use only clean, high-quality, high-germinating seed that is adapted to the climate of the area and to the soils of the farm on which it is to be sown. Meadow mixtures are often covered so deeply that the legumes especially fail to come up. A suitable seedbed, usually one that is mellow on top and firm underneath, should be prepared if the labor is available. By covering seed lightly, a considerable reduction can be made in the quantity of seed to the acre. On the lighter soils, covering the seed with a corrugated roller gives excellent results under a variety of conditions. On silt loams and clay loams in the north Mississippi Valley and in the north central and northeastern states, sowing on the surface and covering lightly with a weeder or a brush harrow are common practices. Beyond question, much clover and other legume and grass seed has been wasted by covering it too deeply. Failure to come up often results from the formation of a crust on the surface of moderately heavy soils. Legume seedlings often cannot penetrate such crusts. A poor stand results unless seeding was done at a heavy rate. Seed treatment, by increasing the percentage of germination, also may aid in holding the acre cost of seed to moderate amounts.

### The Need for Lime

Legumes vary somewhat widely in their lime requirements. Red and sweet clover, soybeans, and alfalfa are regarded as having moderate to high lime requirements. The annual lespedezas, cowpeas, alsike, and wild white clover grow well without liming on soils that are too acid for the high-lime legumes. Soils should be tested. If found deficient in lime for the particular legume to be grown, the soil should be limed liberally. Liberal liming is particularly desirable at present for the perennial legumes, especially alfalfa which usually occupies the soil for a period of years. For this crop it is essential to divide the application if much more than a ton of limestone to the acre is needed. Putting one-half of the lime on for an intertilled crop is

advisable. The lime becomes mixed with the soil during tillage, and acidity is corrected in part during that season. After the land is plowed for alfalfa the remaining half of the required lime is applied and mixed with the soil. Application well in advance of seeding is particularly desirable when the slower-acting forms such as limestone or blast furnace slag are used. Advance application of lime for red, alsike, and ladino clover is less imperative than for alfalfa.

Finely ground basic slag, rock phosphate, or superphosphate (calcium metaphosphate is satisfactory insofar as it is obtainable) may be used. Legumes make somewhat better use of rock phosphate than nonlegumes. This use of rock phosphate for legumes is feasible, especially near the Tennessee mines where delivered costs are relatively low. In general, the same may be said of basic slag in the areas where its cost delivered and spread on the soil is correspondingly low. The phosphorus

**Alfalfa is an efficient gatherer of nitrogen, but yearly applications of phosphate and potash usually are needed.**

The fact that some soils are calcareous in the surface as well as the subsoil should not be overlooked. This condition would be revealed by testing the soil. Although liming a calcareous soil will do no harm, it cannot be expected to prove profitable for the leguminous crops under consideration here.

Legumes are heavy feeders on many of the mineral plant nutrients. Many soils aside from the bluegrass area of Kentucky and perhaps other local areas, are deficient in phosphorus. Phosphorus should be applied in liberal quantities, particularly for the longer-lived legumes.

in slag is regarded as available and, in addition, slag carries other essential mineral nutrients of value. Superphosphate is used in the East, Southeast, South, Southwest, and to some extent in the Midwest.

Basic slag and rock phosphate do not lose availability in the soil. Applications of one-half to one ton per acre, therefore, are feasible and usually profitable. Liming the soil sufficiently to produce red clover should aid greatly in holding phosphorus in relatively available forms in the soil.

Because surface application of super-

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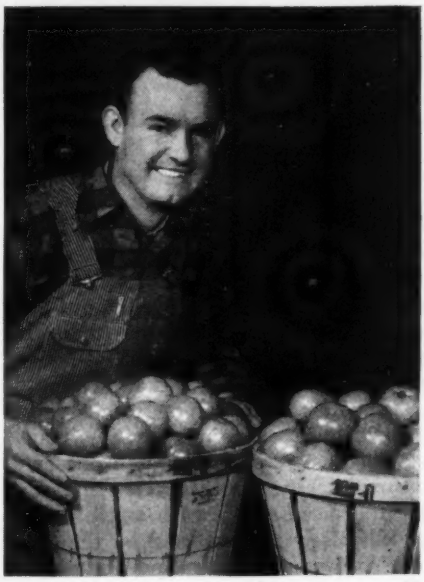
# Indiana's Red Gold

*By Roscoe Fraser*

Agricultural Extension Service, Purdue University, Lafayette, Indiana

DRIVING on any of the highways or crossroads through Indiana last fall, you were doubtless amazed at the amount of tomatoes you saw—vast fields of tomatoes, Indiana's own red gold, with rows of filled hampers crossing them, nimble-fingered pickers filling yet more hampers. Trucks of every kind, size, and description, big semi-trailers, regular farm trucks, trailers hitched behind the family car or tractor, every type of conveyance hurrying toward the nearest canning factory. Trucks lined up for blocks around the canneries waiting to unload. Indiana farmers were busy doing their bit for the National Defense Program.

Under the Lend-Lease Bill 15 million cases of tomatoes were ordered for foreign shipment by the Federal Surplus Commodities Corporation. Indiana's share of this order was 1½ million cases. Indiana was the only state able to fill her quota, although the order was not signed until May 7, after much of the planting had been done.



**Gilbert Sharpe of Kempton, Indiana's 1941 champion tomato grower.**

Normally every year 25,000 farmers grow tomatoes for the canning industry on 75,000 to 100,000 acres in the Hoosier State. Three million cases of tomatoes are packed annually in the 250 Hoosier canneries. It is estimated that last year with an increase of only 25 per cent in acreage, four million cases of tomatoes were packed, 35 per cent more than formerly. Hoosiers accept this as just one more proof that Bill Herschell was right when he wrote, "Ain't God Good to Indiana?"

Champion 1941 tomato grower, winning over 6,000 other club members, was Gilbert Sharpe, who lives near Kempton, in Clinton County, Indiana. Mr. Sharpe drives a school bus and works by the day for his neighbors, renting only about six acres for tomato raising. His yield was 21.672 tons per acre, grading 83.74 U. S. No. 1's. When he was asked how he had maintained such a grade, one of his neighbors who was present said, "Because he left those tomatoes in the field three or four days too long each picking."

This tomato field was fall plowed seven inches deep. The last of April it was gone over with a spring-tooth harrow. Just before plant-setting time, 85 pounds of muriate of potash per acre were put on with a lime spreader. The ground was again gone over with a spring-tooth harrow, then double disked twice. After that 150 pounds of 2-16-8 per acre were put on with a wheat drill.

Certified Georgia-grown Indiana Baltimore plants, 3,500 per acre, were

set May 23, 24, and 25. The plants were set deep, in rows 3′6″ x 3′6″. Starter solution made of 8-20-5 was used.

Three acres were cultivated twice with an International cultivator, applying 75 pounds of 3-12-12 per acre each time. The other three acres were also cultivated twice, receiving 75 pounds of 3-9-18 each time. Mr. Sharpe intended to keep a close check on these two plots, but the tomatoes came so thick and fast that the records were all mixed up. Besides the two cultivations, the field was hand-hoed once. Twice the plants were dusted by airplane with cuprocide. The first dusting also contained calcium arsenate for tomato worms.

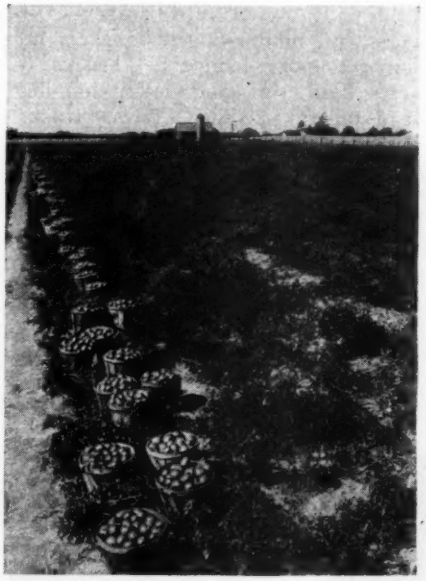
Sweet clover, cut early for hay, was grown on this field in 1940. After the hay was cut, the field was pastured. In 1939, 70 bushels of oats per acre were produced here, and in 1938 the field was planted in corn, producing 80 bushels per acre. When this farm was purchased by the present owner in 1929, it was in very poor condition, but by the use of sweet clover and pasturing the ground has been built up to a high state of fertility.

Mr. Sharpe's tomatoes were picked by five itinerant pickers, one woman picking 210 hampers in six hours. From this field of 5.9 acres, 127,867 tons of tomatoes were picked, and about two tons per acre were left in the field when the factory closed.

Indiana's soil is particularly adapted to the growing of highest quality tomatoes, and last year climatic conditions were just about right; early rains to get the plants started, then hot, dry growing weather, with the fall rains coming late enough to interfere very little with picking.

The quality produced was a long jump from the tomatoes that were introduced into Europe during the sixteenth century from western South America where they were grown as perennial herbs. Small and wrinkled, they were then regarded with disfavor as a food and were used only as garden ornaments. Not until the nineteenth century was much done toward their development and introduction as a vegetable.

Purdue University and the Indiana Canners Association have been working for more than 25 years to develop better tomatoes, to increase quality and quantity. One wonders if better tomatoes than were grown last year can be produced; tomatoes of such lusciousness, good color, and meatiness



**Tomatoes on Charles Powers' farm near Kokomo ready for transporting to the factory.**

that they would almost melt in your mouth; tomatoes growing so abundantly on the vines that a hamper set in a square formed by four plants could be filled from those plants—35 pounds or more from four plants at one picking! Many pickers averaged 200 hampers a day. One teen-age girl picked 152 paskets in a day. As many as 10 tons were picked from one acre at one picking. Fields were gone over by the pickers once each week.

Schools were conducted by the Purdue University Horticultural Extension Tomato Specialist to train pickers to

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# Nutrient Availability

## *An Analysis*

*By S. R. Dickman*

Soil Chemist, Agricultural Experiment Station, Urbana, Illinois

ONE of the most misused and misinterpreted terms in all agronomic science is "availability." A reading of the soil literature of the past one hundred years reveals that the term is an old and popular one that has been widely used without ever having been defined. Some idea of the present status of the term may be obtained by a careful reading of the papers in two recent symposia on availability (1, 9, 18, 19, 23, 24, 27, 29, 30, 33, 35). These papers clearly demonstrate the lack of general agreement on the concept, and also show that many soil scientists are aware of the confusion, vagueness, and ambiguity in this realm of their work. Since this condition exists, the next question is, "What is the most satisfactory method of solving the difficulty?" The author will attempt to answer this question by presenting, as impartially and thoroughly as he is able, a review of the various usages and meanings of the term, a critical analysis of present concepts, and some suggestions and definitions which may be found useful by other workers.

In a previous paper (12) the author attempted to show that the term "the available nutrient" is *not* a symbol for something definite in the soil, and suggested that it be no longer used to express the results of chemical soil tests. In that discussion the term "availability" was used with a precise, though not explicitly stated meaning. It thus appears that availability can be rigorously defined in terms of the operations of its measurement. Such a definition, however, would restrict its use to the conditions of the experiment, and new terms would have to be coined to cover the other meanings and usages which availability now has. Such a procedure might be feasible if agriculture were more strictly a science. The fact that so many agronomic technical words are used by non-scientists, extension workers, farm advisers, farmers, etc., makes especially difficult a wide acceptance of a new definition of an old term. For these reasons no attempt will be made to define availability, but several new terms will be introduced and defined.

### Present Usages of Availability

In general there have been two viewpoints involved in availability studies. One emphasizes variations in the ease of absorption of different available forms of a nutrient, while the other emphasizes variations in amount of an available nutrient present in different soils. According to the former, which will be called the "ease" concept, superphosphate would be said to have a higher availability than rock phosphate. According to the latter, which will be called the "amount" concept, the availability of a nutrient is said to increase as its quantity in a given soil increases.

An example of the ease concept is afforded by Bray (6) in speaking of the difficultly soluble soil phosphorus: "Even though difficultly available, this fraction often furnishes crops with significant amounts of phosphorus, partly making up for its low availability by its presence in relatively large quantity." Another example of this viewpoint is found in the bulletin by Bartholomew (4) who added a series of phosphatic fertilizers to soils in pots and

grew Sudan grass on them. He states, "Therefore, the growth of crops after an application of a phosphatic fertilizer should give a reliable index to the availability of the phosphorus in the fertilizer applied." The ease concept is based on the assumption that some idea of the total amount of the nutrient is known. If the same amount of phosphorus was absorbed by a crop from two forms of phosphates, one of which was present in twice the quantity of the other, the form in the lesser concentration would be considered to have double the availability of the other. Conversely, it has been reasoned that if equal weights of different fertilizers or nutrient elements are added to a soil, the jar or plot from which the crop has absorbed the greatest amount of the element or on which the highest yield has been obtained will indicate the material of the highest availability.

Many examples of the amount viewpoint come from Truog and his students. Thus Ford (13) in studying phosphorus availability in Kentucky soils concluded that since the "available phosphorus" values (as determined by Truog's method) on the limed plots of six fields were not much higher than those on the check plots, "the use of lime did not seem to influence the availability of the native phosphates." Likewise, Cook (10) determined "readily available" phosphorus by Truog's method in soils that had been either limed or had calcium hydroxide added and concluded that, ". . . in seven out of ten acid soils ranging from pH 4.83 to pH 6.30, lime significantly increased the availability of soil phosphates while in two cases it caused only slight increases." Hester (17) also has utilized the Truog method of determining "available phosphorus" as a criterion of phosphorus availability. The A.O.A.C. (2) method of determining available phosphorus in a fertilizer is also based on the amount concept. The greater the amount of phosphate soluble in the extractants used, the greater the content of available phosphorus in the material, and consequently the higher the availability of the fertilizer. Other examples can be given but it is thought that these are sufficient to illustrate what is meant by the amount concept.

The recognition of these basically distinct notions leads to a consideration of what we mean when we say, "Phosphorus availability is increased when superphosphate is added to a soil." Has phosphorus availability been increased because the total amount of available phosphorus has been increased or is it because a substance of higher availability than the phosphorus compounds originally present in the soil has been added?

### Other Uses of Availability

1. Mitscherlich. Although the amount and ease viewpoints are the most common found in American publications, the Mitscherlich conception of "available nutrient" occurs frequently in agrobiologic literature (26, 36). This usage of "available nutrient" seems to express a combination of both the amount and ease concepts. The amount of an available nutrient in a soil is said to be calculated by substituting known values in the Mitscherlich yield equation. This value is determined on the basis of the proportional dry weight or yield increase of a crop to added fertilizers, and is not dependent on chemical soil analysis. For example, "the available phosphorus" in the Mitscherlich sense does not involve any direct assumptions as to either the ease of absorption of different phosphates, the chemical forms in which phosphorus occurs in soils, or the amount of any one form of phosphate present in a soil.

2. Neubauer. The Neubauer conception of "available nutrient" is similar to the Mitscherlich viewpoint in that plant responses are used as the criteria of availability of nutrients in both. Details of this method may be found in articles by Thornton (32) and McGeorge (25).

3. Jenny. Jenny and Ayers (22), in

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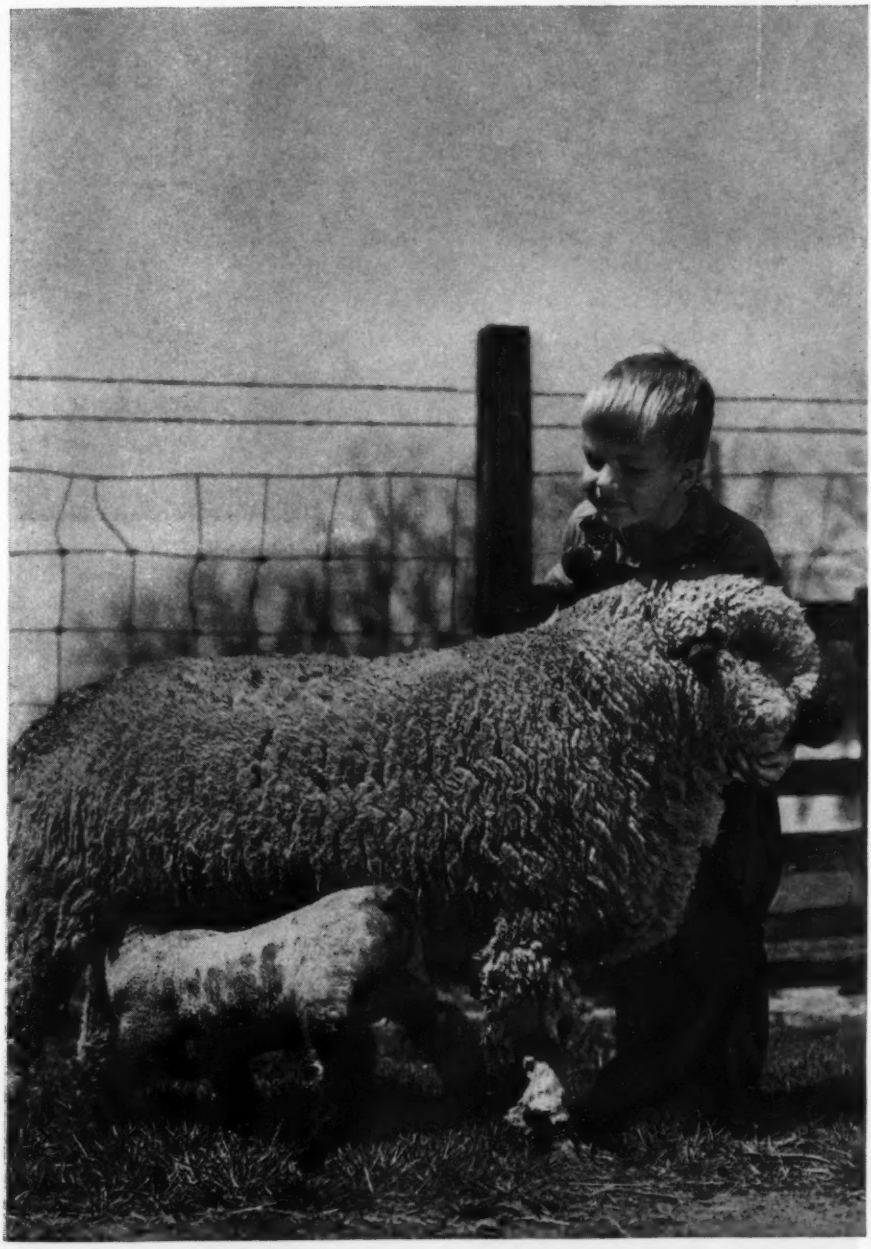
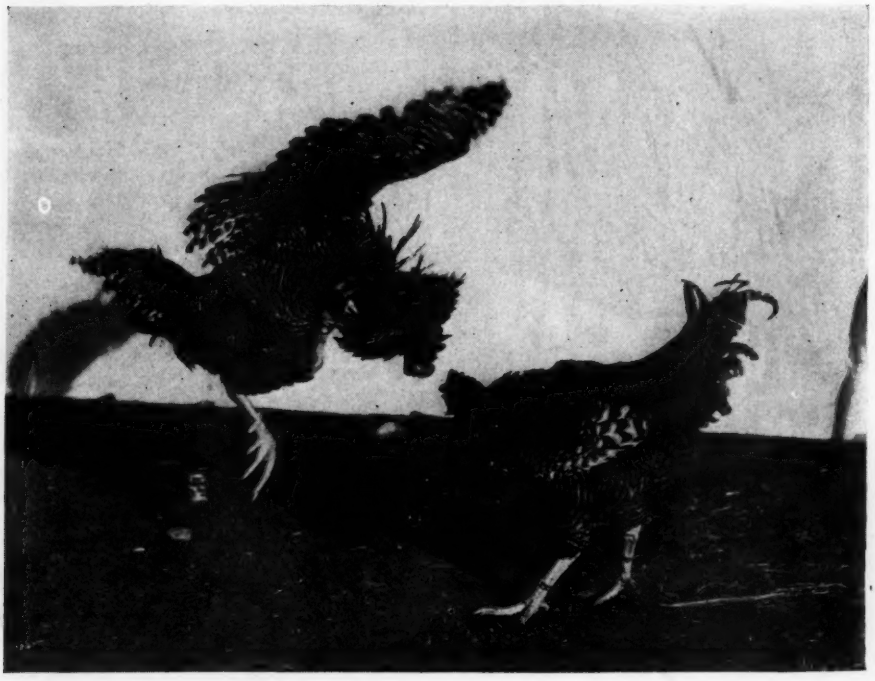
# PICTORIAL

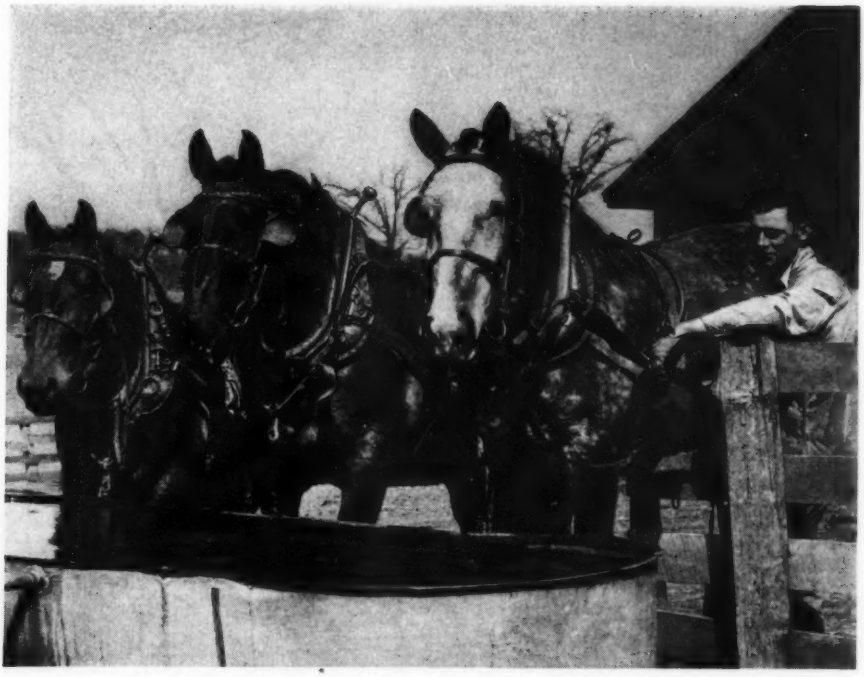


A CAREFUL SHEPHERD SEES THAT HIS FLOCK IS WELL FED.

Above: Modern mechanized horsepower in full swing.

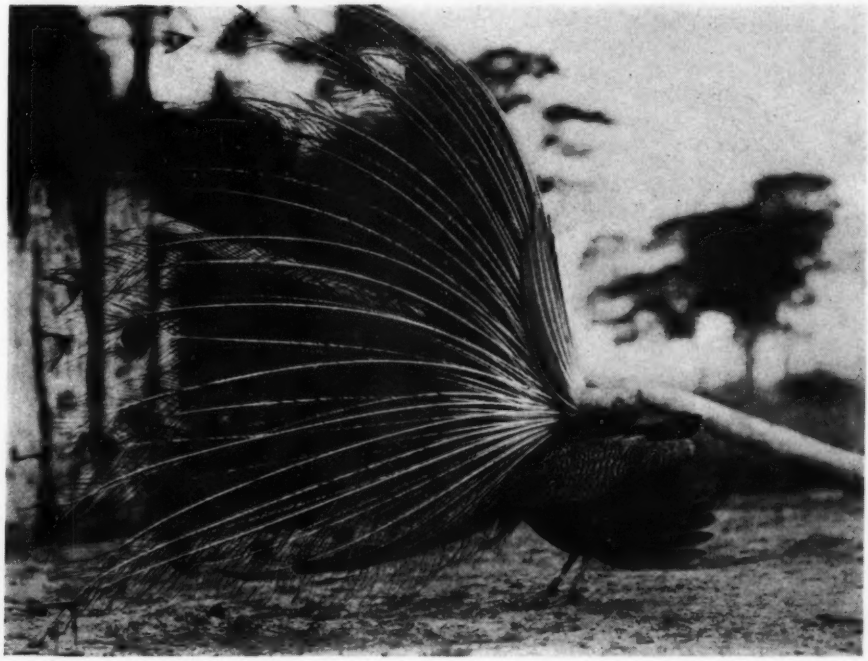
Below: Blitzkrieg in the barnyard.





**Above: This type of horsepower never goes out-of-date.**

**Below: Caught in a March wind.**



**Above: A 100-year-old cottonwood tree bows to civilization.**

**Below: Twisted and bent, but still a monarch.**

# The Editors Talk

## Our Cover

The emblem appearing on the cover of this issue, although only introduced the latter part of January, is now becoming well known to the reading public. It was especially designed by Walt Disney to identify United States food products wherever they are sent throughout the world. Made available by the Government for the voluntary use by packers, it is expected to become a familiar part of the labels for food containers.

The detail of the emblem shows an American Eagle poised protectively over a cargo boat, fending off a bombing plane. The four stars represent the four freedoms pledged in the Atlantic Charter and later by the United Nations—freedom of speech and expression, freedom of every person to worship God in his own way, freedom from want, and freedom from fear.

"Farmers and all of us are proud of the contribution United States food is making, and will make increasingly, to the job of building and maintaining the fighting strength of the United Nations," said Secretary Wickard. "The new emblem is a symbol. It visualizes the determination to see that American food is used as a powerful weapon in winning the war—and in building the right kind of world when peace comes."

There is no doubt that the American farmer is "all out" for Victory. The addition of this "trade-mark" to stamp his contributions in the eyes of the general public can but help the rapidly increasing realization of the importance of an efficient agriculture in any nation's existence.

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## Business As Usual

"Business as Usual" is out. Since Pearl Harbor, things have been happening so fast that there probably is no business left which has not felt the demands of the crisis in which the Nation finds itself. The new agricultural goals have been widely publicized, and all industries allied with agriculture not only have had their "priorities" to deal with, but have been made to feel keenly the necessity for a more efficient production which is being put upon the grower.

In the January issue of this magazine we were privileged to present the viewpoint of a government official on the use of more efficient fertilizers in the Victory Program. This month we have another article on higher analysis fertilizers, this time by M. H. Lockwood, Manager of the Fertilizer Division of the Eastern States Farmers' Exchange, who has had many years of experience in the manufacture of fertilizers to conform with official state recommendations and the public demand. Mr. Lockwood emphasizes, as did Mr. Mehring in January, the greater efficiency of high-grade materials and the savings in manufacturing and distribution costs.

"Probably the chief difficulty we in the fertilizer industry have to overcome is

the mental hazard of 'figures,' " Mr. Lockwood says in connection with "business as usual." "It is human for us all to like something because we are accustomed to it. We become used to the grade numerals of a particular mixed fertilizer. We become used to a certain analysis of an item like superphosphate and muriate of potash and if we are not careful, we find ourselves in the awkward position of leaving our fertilizer grades too much like they used to be without taking into consideration the sound changes that could be made in them if we took advantage of the increases in analysis of the ingredients that go to make up those mixtures."

Thus does Mr. Lockwood aptly apply to his industry the hold which habit gets on everyone who is not alert to the advantages so very often obtainable in "change." This application to growers, by and large, is even more fitting, since one of the long-recognized drawbacks to improved agriculture has been the resistance agricultural advisory forces have encountered in getting widespread adoption of new practices.

Higher analysis fertilizers are on the market. They are being recommended and many growers are using them. Because of their proved efficiency and the need for the employment of every efficiency in meeting the new production goals, more and more emphasis must be placed on the advisability of using concentrated plant-food mixtures. It will be a change in habit for the majority of the growers, but "business as usual" is out.

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# Selective Service For Each Acre

These five words, "Selective Service for Each Acre," bring the war down to the land and might well become the slogan of every farm-owner, renter, and share-cropper for the duration. We saw them as the title of an article by Glennon Loyd in the March 1942 issue of the magazine, Soil Conservation. They have a ring, are easy to remember, and seem to furnish the clue for the farmer torn between his desire to go "all out" in line with the emergency and still keep within the bounds of allotments, production goals, and the teachings of soil conservation.

There must be many such farmers, men who remember the disastrous after-effects of plowing up every available acre during the last war and yet who are anxious to do everything in their power to produce the food, textile, and other agricultural products needed to win this war. If they can find the time to analyze their acres as the draft boards analyze the draftees which come before them, considering the best fitted first, and classifying the others in relation to their ability to produce, a start has been made.

Mr. Loyd in his article has several suggestions for conserving cropland while producing, among them: liming acid soils; using commercial fertilizer; installing soil-conserving rotations; holding soil and water on the hillsides by contouring; and preventing wind erosion. He sees no reason for bleeding the remaining topsoil from our hills nor any excuse for removing what is left of the precious fertility from our other less productive soils. He sees little need for farmers to call gully scarred or wounded acres to the front lines of this food production campaign.

Selective service will involve continuance of the principles of good soil management which employ the best land first, more production from fewer acres through the use of proper fertilizers, improvement and increased use of grasslands, and the expansion of those lines of farming activity in which the operator has had the most experience. The acres to be deferred now should serve in other capacities, such as forestry, or be built up for a higher classification in future selective service.

# REVIEWS

**This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.**

## Fertilizers

*"Inspection of Commercial Fertilizers and Agricultural Lime Products," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 109, Sept. 1941.*

*"Fertilizer Analyses and Regulations, 1941" St. Dept. of Agr., St. Paul, Minn.*

*"Fertilizer Report, 1940," St. Dept. of Agr., Harrisburg, Pa., Gen. Bul. 577, Vol. 24, No. 5, Sept.-Oct. 1941.*

*"Arsenic in Natural Phosphates and Phosphate Fertilizers," U. S. D. A., Washington, D. C., Tech. Bul. 781, Nov. 1941, T. H. Tremearne and K. D. Jacob.*

## Soils

"The Muck Soils of Michigan," by Paul M. Harmer, Special Bulletin 314 of the Michigan Agricultural Experiment Station, is the most complete publication available on the farming of organic soils in the northern United States. The chemical composition of a number of peat and muck soils and of several mineral soils for comparison is given. It is pointed out that the organic soils usually are much lower in phosphoric acid and potash and frequently also in manganese than many mineral soils. The origin and method of formation of various muck soils and the influence of these differences on the properties of the soils and their practical bearing on soil management are discussed.

A classification of muck soils into three broad groups based on the lime content is made. Lime is recommended for the low-lime mucks, while on the alkaline mucks sulphur and manganese sulphate usually are recommended. The use of borax to control cracked-stem of celery, girdle of table beets, and boron deficiency disease of sugar beets is recommended with the rate of application 25 to 100 pounds of borax per acre. Copper sulphate has been found beneficial on most of the acid mucks, particularly when carrots, lettuce, onions, potatoes, spinach, and tomatoes are grown. Ordinary rock salt also has been found beneficial to some crops but is not at all beneficial to others.

The use of fertilizers for all of the crops commonly grown on muck soils is discussed in detail. In the general consideration of the use of fertilizer, it is pointed out that muck soils are usually relatively higher in nitrogen and, therefore, this nutrient frequently is low or entirely lacking in the fertilizer used on muck soils. Phosphates are moderately lacking and are usually included in a fertilizer for muck soils, while potash is generally needed the most and, therefore, is included in practically all muck fertilizers. The age of the muck, the type of muck with reference to its lime content, the crops grown, and previous fertilization will also influence the choice of the best fertilizer to use. Among the analyses recommended for the various crops are 0-8-24, 2-8-16, 3-9-18, 3-12-12, 0-20-20, 0-10-20, and 0-8-32. Rather detailed information is given on drainage, irregation, breaking new mucks, cultural practices, frost and temperature relationships, wind injury and its prevention, and crop adaptation.

*"Limestone, the Key to Soil Conservation," Agr. Ext. Serv., Urbana, Ill., May 1941, C. M. Linsley.*

*"Solving Land-use Problems," Agr. Ext. Serv., Orono, Maine, Ext. Bul. 298, Jan. 1942, Stacy R. Miller.*

*"The Muck Soils of Michigan—Their Management and Uses," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 314, Dec. 1941, Paul M. Harmer.*

*"Effects of Slope, Character of Soil, Rainfall, and Cropping Treatments on Erosion Losses from Dunmore Silt Loam," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 72, Aug. 1941, James H. Lillard, H. T. Rogers, and Jesse Elson.*

*"The Effect of Green-manure Crops on Certain Properties of Berks Silt Loam," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 73, Sept. 1941, S. S. Obenshain and P. T. Gish.*

*"Report of the Chief of the Soil Conservation Service, 1941," U. S. D. A., Washington, D. C.*

## Crops

¶ A simple and practical publication on pasture improvement has been prepared by E. D. Walker and J. C. Hackleman and issued as a mimeographed Department of Agronomy pamphlet by the Extension Service of the University of Illinois. This is entitled "Five Steps in Pasture Improvement." These steps include: first, the testing of the soil and the application of lime, phosphate, and potash as needed according to the results of the test; second, disking in order to work the lime and fertilizer into the soil and provide at least a semblance of a seedbed; third, heavy seeding principally with sweet clover but also with alfalfa, alsike or red clovers, and with timothy, redtop or orchard grass possibly also included; fourth, careful grazing so as not to over-graze or under-graze; and fifth, clipping of the weeds so as to give the desirable forage plants a better chance to grow. Somewhat similar directions are also given for establishing new pastures. This bulletin is well worth study by everyone who has to deal with pastures.

*"Hays and Hay Making in the Prairie Provinces," Dom. Dept. of Agr., Ottawa, Ont., Pub. 722, Farmers' Bul. 104, Nov. 1941, M. J. Tinline.*

*"Apple Harvesting and Storage in British Columbia," Dom. Dept. of Agr., Ottawa, Ont., Pub. 724, Farmers' Bul. 105, Nov. 1941, J. E. Britton, D. V. Fisher, and R. C. Palmer.*

*"Crotalaria for Forage," Agr. Exp. Sta., Gainesville, Fla., Bul. 361, Aug. 1941, Geo. E. Ritchey, Roland McKee, R. B. Becker, W. M. Neal, and P. D. Dix Arnold.*

*"Bromegrass," Agr. Ext. Serv., Urbana, Ill., Apr. 1941, R. F. Fuelleman.*

*"Five Steps in Pasture Improvement," Agr. Ext. Serv., Urbana, Ill., June 1941, E. D. Walker and J. C. Hackleman.*

*"Annual Report of the Maine Extension Service for the Year Ending June 30, 1941," Agr. Ext. Serv., Orono, Maine, Ext. Bul. 299, Dec. 1941.*

*"Commercial and Experiment Station Corn Yield Trials, 1941," Agr. Ext. Serv., University Farm, St. Paul, Minn., Ext. Pamph. 88, Jan. 1942, Ralph F. Crim.*

*"Small Grains in Minnesota," Agr. Ext. Serv., University Farm, St. Paul, Minn., Ext. Bul. 228, Nov. 1941, W. W. Brookins.*

*"Orchard Grass in Missouri," Agr. Ext. Serv., Columbia, Mo., Cir. 431, July 1941, E. Marion Brown.*

*"Science and the Land—The 62nd Annual Report of the New Jersey State Agricultural Experiment Station and the 54th Annual Report of the New Jersey Agricultural College Experiment Station, 1940-41," Agr. Exp. Stas., Rutgers Univ., New Brunswick, N. J.*

*"Apple Growing in New York," St. Agr. Exp. Sta., Geneva, N. Y., Cir. 158, Rev. Oct. 1941.*

*"Strawberry Production in Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 626, Jan. 1942, Leon Havis.*

*"Utilization of Home Grown Feeds in Fattening Steers in the Trans-Pecos Region," Agr. Exp. Sta., College Station, Texas, Bul. 604, Sept. 1941, J. H. Jones, J. M. Jones, and J. J. Bayles.*

*"Barley Production in Texas," Agr. Exp. Sta., College Station, Texas, Bul. 605, Sept. 1941, I. M. Atkins and P. B. Dunkle.*

*Factors Affecting Physiological Breakdown of Maturing Tobacco," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 74, Oct. 1941, G. M. Shear.*

*"The 4-H Club Garden," Agr. Ext. Serv., Pullman, Wash., 4-H Cir. 58, Nov. 1941, John C. Snyder.*

*"Growing Grapes in Washington," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 271, Aug. 1941, John C. Snyder.*

*"Growing Austrian Winter Field Peas in Washington," Agr. Ext. Serv., Pullman, Wash., Ext. Cir. 38, Nov. 1941, Leonard Hegnauer, I. M. Ingham, and L. G. Smith.*

*"Peach Growing in Washington," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 162, Aug. 1941, E. L. Overholser, A. L. Kenworthy, and R. M. Bullock.*

*"Experiments on the Burn of Cigars," Agr. Exp. Sta., Madison, Wis., Res. Bul. 140, Aug. 1940, James Johnson.*

*"Report of the Chief of the Bureau of Plant Industry, 1941," U. S. D. A., Washington, D. C.*

*"Report of the Chief of the Bureau of Agricultural Chemistry and Engineering, 1941," U. S. D. A., Washington, D. C.*

## Economics

¶ "What the Farm Should Contribute Toward Family Living" is the title of an interesting Popular Bulletin (No. 163) of the State College of Washington Agricultural Experiment Station. The bulletin was prepared by a special committee representing the Agricultural Experiment Station and the Agricultural Extension Service of the State College of Washington, the State Nutrition Committee, and the State Land-use Planning Committee.

Interest in nutrition, while not new, has received considerable stimulus as a result of the war. Even before the beginning of this war, more and more attention was being given to a balanced national diet and to the problems of producing products sufficient to provide such a diet. The first paragraph of the prefatory note states very clearly the far-reaching importance of a properly balanced diet. "That every family be well fed is of vital importance. Without proper nutrition neither children nor adults can be in the best physical condition. No job is more important than the proper feeding of the men and women of tomorrow. Their wholesome development is essential to the happiness of the family, to the welfare of the community, and to the future of the Nation."

The bulletin deals specifically with problems in the growing of essential food requirements on Washington farms, but is applicable in a general way to large areas of the United States. The foods which should be provided for every boy and girl, man and woman, for proper health are milk and milk products for vitamin A, calcium, phosphorus, and protein; eggs for vitamin A, iron, phosphorus, and protein; fruits and vegetables for vitamins A to G inclusive and many necessary minerals; meats for protein, which builds strong muscles and other body tissues, phosphorus, and iron. Cereals in their natural state are important in all diets because of their rich source of vitamin B complex and iron. It is difficult to secure adequate quantities of the B vitamins unless reasonably generous amounts of whole grain are included in the daily diet.

According to the interesting charts shown in the bulletin, 50% of the farm families receive good diets, 25% receive fair diets, and 25% poor diets, whereas in villages and cities only 20% receive good diets, 45% fair diets, and 35% poor diets. It has also been shown that on the farms where a large percentage of home-produced products are consumed, the families on the whole receive better than average diets. According to data quoted in the bulletin, it requires about $700 per year to properly feed a family of five, whereas data from the Washington home accounts indicate that 65% to 75% or $400 to $600 of the value of the food needs for the average family can be produced on the farm in most sections of the State. It is suggested that farmers can use this means of increasing their real income quite successfully. For example, in order to produce $500 worth of food products, it would take about 8 cows or 450 hens, or in terms of wheat about 775 bushels.

The State has been divided into four districts and the discussion of gardens centers around the crops that are adaptable in the different districts. The bulletin contains interesting data on the type of crops to grow, a typical plan for a garden for a family of five, the time to plant, and the materials needed. Other sections deal with the production of dairy products and other animal products on the farm. In view of the wide interest in family gardens as a result of the war, this publication should prove of wide interest throughout the United States.

*"Arizona Agriculture, 1942, Supplies, Prices, and Income," Agr. Exp. Sta., Tucson, Ariz., Bul. 178, Jan. 1942, George W. Barr.*

*"Connecticut Vegetable Acreages, 1939, 1940, 1941," St. Dept. of Agr., Hartford, Conn., Bul. 75, Jan. 1942.*

*"The Challenge to Democracy," Agr. Ext. Serv., Ames, Iowa, Bul. P26, Oct. 1941, E. D. Ross.*

*"Classification of Agricultural Areas, Frederick County, Maryland," Agr. Exp. Sta., College Park, Md., Bul. 440, Apr. 1941, Robert W. Harrison and Paul L. Searfoss.*

*"A Study of Dairy-farm Management in Onondaga County, 1938 and 1939," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 767, Oct. 1941, R. W. Hoecker.*

*"An Economic Study of the Organization and Management of Beef Cattle and Other Types of Farms in Russell County," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 71, July 1941, J. J. Vernon.*

*"Washington Apples on the New York and Chicago Fruit Auctions," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 275, Oct. 1941, Mark T. Buchanan.*

*"Settlement and Development of Cut-over Lands of Western Washington," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 277, Nov. 1941, Carl P. Heisig.*

*"Looking Ahead into 1942," Agr. Ext. Serv., Pullman, Wash., Cir. 41, Dec. 1941.*

*"Washington Apples on the New York and Chicago Fruit Auctions," Agr. Exp. Sta., Pullman, Wash., Bul. 401, June 1941, Mark T. Buchanan.*

*"The Marketing of Washington Apples in Los Angeles, California," Agr. Exp. Sta., Pullman, Wash., Bul. 406, Sept. 1941, Mark T. Buchanan and E. F. Dummeier.*

*"After Three Years: A Restudy of the Social and Economic Adjustment of a Group of Drought Migrants," Agr. Exp. Sta., Pullman, Wash., Bul. 407, Oct. 1941, Paul H. Landis.*

*"Report of the Director of the Office of Foreign Agricultural Relations, 1941," U. S. D. A., Washington, D. C.*

*"Report of the Administrator of the Agricultural Adjustment Administration, 1941," U. S. D. A., Washington, D. C., G-113, Nov. 1941.*

*"Wartime Work Program of the Bureau of Agricultural Economics," U. S. D. A., Washington, D. C., Jan. 1, 1942.*

*"Farm Adjustments in the Southeast to Meet Defense Needs," U. S. D. A., Washington, D. C., Prelim., Nov. 1941.*

*"Farm Adjustments in the South Central States to Meet Defense and Post-war Needs," U. S. D. A., Washington, D. C., Dec. 1941.*

*"Farming Adjustments in the Northeast to Meet Defense and Post-defense Needs," U. S. D. A., Washington, D. C., Nov. 1942.*

*"Farming Adjustments in the Far West to Meet Defense Needs and Stabilize Agriculture," U. S. D. A., Washington, D. C., Rev. Oct. 1941.*

*"Planning Adjustments on Truck Crop Farms in Wicomico County, Maryland," U. S. D. A., Washington, D. C., June 1941.*

# High-Grade Fertilizers Are More Profitable

(*From page* 12)

The success of this and similar changes indicates, we believe, the readiness of most of us to follow well-reasoned changes.

Fertilizer users frequently wonder whether they are changing to as satisfactory a mixture when they use higher analysis grades. The answer is fairly simple and positive: first, that crop yields are as high with one as with the other; second, that whether the user is a potato grower applying a large amount of fertilizer on each acre or a grower of corn or wheat or grass using relatively smaller amounts, the returns have been equally good. Another important consideration is that the higher analysis ingredients contain generally as little or less of the factor called "soluble salts" for each unit of plant nutrients furnished. Thus one ton of 4-8-8 usually has more total soluble salts than 1,600 pounds of a 5-10-10, and one ton of 4-16-20 has less potential crop injury factors in it in terms of total salts than two tons of 2-8-10.

May I venture the opinion that if fertilizer consumers have presented to them 20- and 25-unit mixtures in place of the present 15- and 20-unit grades, most of them will make the change provided those presenting the change make the presentation constructive and really try to put such a program across. I am also quite confident that such a change can be made rather abruptly as well as smoothly. I am equally confident that everyone involved will gain directly or indirectly from it.

# Nutrient Availability—An Analysis

(*From page* 22)

discussing the influence of the degree of potassium saturation on potash absorption by barley roots, state, ". . . the degree of saturation assumes a dominant role because it controls the exchangeability and therefore the availability of nutrient ions." They conclude that with any given degree of potash saturation, the nature of the complementary ion markedly affects the availability of potassium. This view seems to be a special case of the "ease of absorption" concept since here the chemical form of the nutrient as well as its amount is constant. Tiulin (34) has discussed similar relationships with regard to the availability of absorbed phosphate.

### Criteria of Availability

Another aspect of the question is that of deciding what measurement or group of measurements give the most reliable index of the availability of nutrients. Evidently there are two separate schools of thought on this subject: (1) that which favors soil measurements; and (2) that which favors plant measurements. Since a review of the first group was discussed in a previous paper, (12) only the second group will be mentioned here. The Neubauer method utilizes plant analysis and absorption of nutrients, whereas the Mitscherlich calculations are based on total dry weight of plant substance produced. On the other hand, the results of most field experiments with fertilizers are judged on the basis of the yield produced, with or without quality considerations.

Another divergence in availability studies is connected with the amounts of fertilizer applied to the soil. Some workers (28) have added equal weights of the fertilizers being compared. Others (15) have supplied equal weights of the nutrient element in the fertilizer, while still others (5) with a more practical viewpoint have added equal money values of the materials to be tested. There are comparatively few field experiments which include more than one increment of the fertilizer being tested. When these diverse methods, all presumably concerned with nutrient availability, are considered, it is not surprising that there is so much disagreement on the best use of fertilizers and the proper use of quick tests in American agriculture.

When the question of plant nutrition is examined, it is found that there are two primary interest points: (1) the nutrients in the soil; and (2) the plants themselves. Plants use the essential elements in their growth function. It is evident that there is a relationship between the nutrients in the soil and their absorption by plants. This relationship varies with the type of soil, amount and form of nutrients, kind of crop, length of growing season, water supply, etc., and if any one of these factors is changed in a given experiment, the effect of all the other factors is likewise altered. In other words, nutrient ions in the soil, or fertilizer salts, do not possess an inherent availability as a fixed or constant property.

The author believes that the soil-plant relationship should serve as the fundamental basis of what are now called availability experiments. If this relationship is used as a figurative yardstick with which to measure present availability concepts, it is found that these concepts all fall far short of expressing the whole.

The amount concept thus clearly fails to include one of the two primary subjects in its measurement. Because no plant data are included, this concept must assume that plants differ very little in their "feeding power" for nutrients or in their relative responses to added nutrients. Since the availability of a nutrient in a soil is supposed to be measured by a single chemical determination, this viewpoint also ignores the effect that the presence or absence of

other nutrients has on crop growth and nutrient absorption. Adherents to this viewpoint further ignore the influence of other factors of the soil-plant relationship, such as the physical condition of the soil, the climate, spacing of plants, etc., on ion availability.

When these notions are applied to fertilizer availability, an even larger number of fallacious assumptions appear. Besides all those mentioned above, assumptions are made that there is no interaction between the soil and the fertilizer, and that the time and manner of application of the fertilizer play no part in determining its availability. In short, that the solubility of a fertilizer in a given reagent is the sole criterion of its availability.

To speak of measuring the availability of superphosphate in the laboratory by a chemical method is no more sensible than to claim to measure intelligence by weighing a person's brain. Both availability and intelligence are abstract concepts, and identification of any one of the factors which influence the net result, with the general concept itself, results only in hopeless confusion.

The ease concept is more nearly correct in its approach than the amount viewpoint in that the influence of the plant factors is explicitly recognized. The ease concept assumes first, that the available forms of each element are known and can be accurately measured, and secondly, that these forms do not vary during the course of a growing season. Thus any equilibria between an available form and non-absorbable compounds of the element would upset such calculations, as well as any leaching losses of soluble forms. Another complication that arises from acceptance of this viewpoint occurs when more than one available form of an element is present in the soil. Absorption from one form of a nutrient at an early stage of the plant's development may profoundly influence uptake from another form at some later phase of development and thus the ease of absorption and hence the availability would not depend solely on the chemical characteristics of the second form with any given species of plant. An illustration of this is found in the work of Dickman and DeTurk (11), which shows that the presence or absence of soluble phosphate in nutrient solutions at an early stage in the development of the corn plant may result in dry weight increases at later phases which are in direct opposition to phosphorus absorption from either soluble phosphate or rock phosphate.

### Additional Criticisms

Another criticism of the ease concept follows from the fact that in many fertilizer experiments conclusions have been drawn with respect to the availability of the added fertilizers when only one rate of application of each had been made. Many of these experiments have as their object the measurement of the availability of the applied fertilizer. This type of experiment rests on two fallacious assumptions. The primary fallacy springs from the assumption that it is possible to measure the availability of a fertilizer by *any* method. The non-acceptance of this assumption becomes reasonable when one realizes that as soon as a fertilizer is placed in the soil it reacts with the soil and is altered. Furthermore, since no two soils are exactly alike, the change in the fertilizer will be different and the fertilizer will have different effects on the crop being grown (16). An increase in crop growth results from the soil-fertilizer combination, and the yield increase thus obtained should not be attributed solely to either. The usage of Jacob and Ross (21) in speaking of the "efficiency" or "nutrient value" of fertilizers appears to be a simple and convenient way of discussing fertilizer results. Thus if 50 pounds of one fertilizer increased the yield of a crop as much as the application of 100 pounds of another, the efficiency of the former would be double that of the latter on the soil used for the experiment.

This brings us to the second fallacy of the one-rate-of-application experiments, (15, 25). Such experiments assume

that the single amount of each fertilizer added to a soil will lead to a fair comparison of their relative availabilities. Yet how can one be certain that he is making a fair comparison? Mitscherlich (26) has conclusively demonstrated that as larger and larger increments of fertilizer are applied to a soil, crop response from any two successive increments becomes progressively smaller. Crop response from any one addition, therefore, can be properly interpreted only in relation to the yields obtained from a larger and a smaller amount. Conclusions drawn from one-rate-of-application experiments can not justifiably be generalized to cover other rates of application. Of what value, then, are availability measurements from such data?

It would seem, then, that a comparison of fertilizer efficiencies can be most fairly made at equal crop yields or at equal amounts of the element absorbed. A comparison of the amount of each different fertilizer added in the experiment for any given level of crop production then serves as a direct measure of relative fertilizer efficiency. If, for example, it is found that one phosphatic fertilizer helps produce a 150-bushel corn yield, while the maximum yield with another is 100 bushels, no comparison of the efficiency of these fertilizers can be made at the 150-bushel level. The smallest amounts of each which resulted in a 100-bushel yield, however, make possible a quantitative estimation of their relative efficiencies at this level. It should not be forgotten that fertilizers are of importance because of their aid in sustaining and increasing crop yields. Therefore, the most practical common denominator or standard for comparing relative fertilizer efficiencies would seem to be at equal yields.

### Quantitative Agrobiology

Since an adequate discussion of the Mitscherlich approach to availability questions alone would require a long article, the author will not presume to offer an adequate criticism of the theory here. It can be said, however, that from a purely logical viewpoint the Mitscherlich equations and theories form a self-consistent system. Yet some of the assumptions on which this system is based are of doubtful validity and have been seriously questioned by Briggs (8) and by Balmukand (3).

The author has closely examined the Mitscherlich conception of "available nutrient" and wishes to point out some of the qualifications of the term. The available potassium in the Mitscherlich sense does not refer to the amount of potash actually absorbed by the plant, or to an actual quantity of a nutrient form of potassium such as the replaceable potash present in a soil. The measure of available potash is solely in terms of plant yield or dry substance responses. By utilizing the proportional responses obtained with each plant genotype, this viewpoint is said to acquire general applicability. In other words, the available potash is considered to be a constant in a given soil even if two strains of corn yield 25 and 50 bushels respectively on the unfertilized soil. This reasoning assumes that each increment of added potash increases the yield of the second variety exactly twice that of the first variety of corn until the maximum yield of each is attained. An adoption of this viewpoint thus would lead one to predict that a variety with the greatest "quantity of life" (36) would always yield proportionately more than another variety with a lesser "quantity of life" on any given soil. Illinois data (20) that bear on this question are at variance with this prediction.

Willcox (36), in applying the Mitscherlich equation, also considers that the amount of an "available nutrient" is independent of the quantities of the other nutrients present in the soil. He states, ". . . every factor of plant growth has a yield-producing potency that in the limit is independent of the potencies of any and all other growth factors. One Baule unit of potash will always produce 50% of whatever crop the soil is otherwise capable of producing."

The unqualified acceptance of this statement would lead one to predict that the addition of a fertilizer to a soil would always increase the yield of a given variety unless 10 Baule units of that nutrient were already present. This is at variance with other crop yield data secured in Illinois which show that superphosphate additions sometimes result in corn yield decreases. The evidence indicates that the superphosphate additions have induced a higher nitrogen requirement in the crop since the superphosphated plants showed marked symptoms of nitrogen deficiency, whereas the non-phosphated plants appeared normal. It would seem, therefore, that the above data demonstrate that the "available nitrogen" is not an independent variable as is considered in agrobiological literature, but is dependent on the phosphate status of the soil. In the last chapter of his book Willcox recognizes the depressive influence of nutrient unbalance and accounts for it by saying, "This situation discloses that one and the same growth factor may have opposite effects on plant growth and yield." It is thus necessary for him to introduce a negative constant, called the depression constant, into the yield equation. This constant, k, ". . . depends on the character of the hostile influence at work and has to be determined in each specific instance, and, it should be added, for each particular variety of plant" (36). The necessity for introducing a variable "constant" into the universal yield equation causes one to seriously question the general applicability claimed for the Mitscherlich yield equation and the concept of available nutrient derived from it.

In addition, it is difficult to conceive of an independent chemical determination which will confirm the Mitscherlich value for an available nutrient. A chemical test can determine only forms of nutrients or the soluble equilibrium products of a number of forms in a given soil, and these values do not agree with those obtained by the Mitscherlich calculations. It thus appears that any chemical extraction method which is based on a non-chemical available nutrient concept, such as that of Mitscherlich, and is not devised to recognize and to determine specific chemical forms of nutrients in soils is scientifically unsound.

(Continued next month)

*All references will be listed at the end of the next instalment.*

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# The Hope of No-Pone Valley

(*From page* 15)

and loosen up the tight shale subsoil so other crop roots can penetrate.

The Runyans grow alfalfa, too. They fertilize a little heavier than Ledford, however. For 2 acres seeded in 1940, they used per acre applications of 2½ tons lime, 450 pounds 45% superphosphate, 200 pounds muriate of potash, and some manure. Three cuttings made 12 tons of quality hay last year.

Most of the cotton in No-Pone Valley is of the "bumblebee" type. That is, local farmers say, a bumblebee can lay on his back and suck the blooms. Bill Runyan's cotton looked good for a bale per acre. On Apison shale soil, it followed lespedeza and had received 500 pounds per acre of 2-10-4 and a side-dressing 100 pounds of nitrate of soda.

Corn followed rye and crimson clover turned under and was fertilized with 300 pounds of 0-10-4 per acre in the row and side-dressed with 125 pounds nitrate of soda.

The Runyans keep beef cattle. When Bill returned to the farm, they had 4 head; on the same acreage they now

have 54 head. The increase was made possible by more and a better grade of hay and grain and increased carrying capacity of pastures. Most of the crop and some of the pasture land has been terraced during recent years.

### Fertilizer Aids Pioneer

Seventy-five miles away from Ledford and the Runyans in Union County lives D. R. "Uncle Rex" Nicely. He hasn't seen their demonstrations, but has learned a few tricks of his own during 61 years living in the shale valley. Uncle Rex's 107-acre farm and homestead stand out like an oasis in a desert.

What's the trick? Liberal use of lime and fertilizer—a good grade of complete fertilizer—to get red clover, lespedeza, and grasses. This puts organic matter in the soil to keep it from packing and "running together." "Otherwise crops can't stand summer droughts," he says.

Uncle Rex has lived in the shale valley all his life but didn't find out until recent years what response liberal fertilization gave. "If I had known years ago how this old worn-out shale soil would respond to lime, phosphate, and potash, I could have been a rich man," he declares.

Typical pioneers in this country, Mr. and Mrs. Nicely can sit on the porch of their comfortable and attractively landscaped home and look across the valley to a cleared field high up in the ridges where they grew their first crop two years after they married. "Worked as a hired laborer for 50 cents or a bushel of corn a day the first 2 years," Uncle Rex relates. "One day I worked hard all day for a bushel of corn. Took it to the community store and sold it for 30 cents and bought a pound of coffee for 25 cents. It was that night we decided to clear some land and farm for ourselves. I haven't bought a bushel of corn since. We traded our first wheat crop for a milk cow."

Uncle Rex has quite a reputation as a burley tobacco grower. His crop last year was particularly good. A yield of 1,915 pounds per acre sold for an average price of nearly 35 cents. "It was the cheapest crop I ever grew," Uncle Rex says.

In addition to some manure, Uncle Rex used 400 pounds of 3-8-5 fertilizer

**A bale of cotton per acre, unheard of before in No-Pone Valley. Bill Runyan did it by turning under a crop of lespedeza, applying 500 pounds of 2-10-4 per acre, and side-dressing with 100 pounds of nitrate of soda.**

**D. R. Nicely, Union County, Tennessee, turned under barley and crimson clover, applied 400 pounds of 3-8-5 per acre, side-dressed with nitrate of soda, and produced this tobacco which made 1,915 pounds per acre and sold for 35¢ a pound.**

per acre in the hills and side-dressed with 100 pounds nitrate of soda. The field was in barley and lespedeza in 1940 and received an application of 250 pounds 45% superphosphate per acre at that time.

Both Ledford and Uncle Rex are unit-test demonstrators, and Bill Runyan is an area demonstrator in the cooperative farm-improvement program of the Tennessee Extension Service and the Tennessee Valley Authority. It looks as though they may have found "pay dirt" in No-Pone Valley.

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# Lilies for Easter

(*From page* 16)

have to be devoted to this purpose and in more than one climatic zone. The Oregon growers, who operate on exceptionally well-adapted land along the coast, are expected to grow lilies largely for "seed" purposes to be increased in other localities. The situation will be somewhat comparable to that of the seed-potato industry.

Most of the lilies being grown on the Oregon coast are known as the Croft and Kenyon lilies. A third and newer variety grown there is called Slocum's lily, which was judged the best among all those at the Government's Beltsville testing ground in 1941. Experiment station pathologists have been working with the Oregon lily growers in keeping the stock free from the many diseases which are a constant threat to the industry. Virus diseases constitute the worst threat, though these have been successfully controlled in the stock thus far.

The lily industry, while still confined to a comparatively small area, holds such large potential promise that careful study is being given to cultural methods and marketing plans. Fertilizer high in both phosphorus and potash is necessary for the best results. The usual practice is to apply a complete 3-10-10 or 3-12-12 fertilizer unless a leguminous cover crop has been used,

in which case only the phosphorus and potash are applied.

Marketing is largely through established channels, with practically none of the growers attempting any retailing. A movement has been started to obtain state grades and compulsory inspection so as to insure standardization of pack and quality and prevent the new industry from being harmed by even a small quantity of inferior bulbs reaching the market.

Greenhouse men throughout the country who have had opportunity to try the Oregon lilies have been so enthusiastic about the quality and freedom from disease that for several years they have had standing orders for every bulb the growers would part with. Although the first commercial sales of these Oregon lilies were made less than 10 years ago, present indications are that a $3,000,000 industry will be developed within the next 10 years.

# More Legumes for Ontario

(*From page* 9)

ting on August 1. Fine weather prevailed and the hay was all well cured. The weights of air-dry hay in tons per acre were as follows:

| Date of cutting | Plot 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| June 21 .... | 4.99 | 2.45 | 1.18 | 1.09 |
| August 1 .... | 1.18 | .72 | .43 | .24 |
| Yields from 2 cuttings | 6.17 | 3.17 | 1.61 | 1.33 |

As already stated, the weather was unusually dry. Less than three inches of rain fell during May and June when the greatest growth was made. The splendid yields on plot 1 and the reasonably good yields on plot 2 can be attributed to the higher levels of fertility, both directly and indirectly. The dense growth of herbage in early May prevented evaporation of soil moisture, while on plots 3 and 4 much of the ground was uncovered by either grasses or clovers and became seriously desiccated.

In dairy farming in eastern Ontario, one of the most difficult problems confronting the dairyman is the necessity of maintaining an adequate supply of pasture throughout the summer months, particularly July, August, and September. Dr. Newman's farm is no exception in this respect, and during July and August of 1941 pasture became a serious problem. This field was turned over to the milking herd, and sufficient pasture was obtained to maintain an even production of milk. The regular pasture was permitted to recuperate. The cattle were turned in to pasture this area during the first part of August, and in order to obtain subsequent yields cages were placed on all plots and the following dried weight yields in tons per acre were obtained:

| Date of Clipping | Plot 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| August 27 | .90 | .40 | .37 | .37 |
| October 24 | .75 | .45 | .18 | .10 |
| Yields from 2 clippings | 1.65 | .85 | .55 | .47 |
| Total yield hay and clippings | 7.82 | 4.02 | 2.16 | 1.80 |

While these investigations are still incomplete, certain tentative conclusions may be drawn.

(1) Legumes respond in a remarkable manner to high fertility levels.

BALANCE SHEET OF FERTILITY *

| (Three-acre basis) | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ |
| Plant food applied | 152 | 424 | 732 | 152 | 124 | 192 | 142 | 64 | 142 | 137 | 34 | 117 |
| Plant food removed | 441 | 136 | 470 | 263 | 87 | 299 | 190 | 68 | 235 | 161 | 59 | 205 |
| Balance of fertility | −289 | +288 | +262 | −111 | +37 | −107 | −48 | −4 | −93 | −24 | −25 | −88 |

* *Data from: "When Fertilizing Consider Plant-food Content of Crops," J. D. Romaine, Better Crops With Plant Food, Vol. 24, No. 3.*
*"Feeds and Feeding," F. B. Morrison, Morrison Pub. Co., Ithaca, N. Y.*
*"Manures and Fertilizers," F. T. Schutt and L. E. Wright, Canada Dept. of Agr. Bul. 585.*

(2) Moderate applications of a properly selected fertilizer applied to each crop in the rotation have proven highly profitable.

(3) The weather should not be blamed entirely for crop failures in dry periods in this part of the country. Adequate nutrients in the soil are an insurance against drought damage.

An interesting "balance sheet of fertility" can be shown by subtracting the pounds of nutrients removed by the crops from the total amounts applied during the three crop years.

From these figures it may be noted that the only plot in which fertility levels are actually being raised is in plot 1. With respect to nitrogen, no figures are obtainable at this date as to the amount of nitrogen accumulated in the roots and residue of the legumes, but it is known to be a substantial amount, probably not less than 200 pounds for each 3 tons of hay harvested. At any rate, there were no symptoms of nitrogen deficiency on either plot 1 or 2. On the contrary, a luscious foliage was found on these plots right up until frost.

Soil samples have been taken from the plots at regular and frequent intervals. To date the results of soil tests have shown a remarkable conformity with the appearance and yield of the legume crop and with the amounts of plant food applied. Plot 1 is the only area on which soil tests indicate higher levels of phosphate and potash. Plots 3 and 4 show extremely low mineral content, while plot 2 is somewhat better but still low.

That the quality of the forage has been affected by soil treatment is also shown by the following data:

COMPOSITION OF HAY IN POUNDS PER ACRE (OVEN-DRY BASIS), FIRST CUTTING JUNE 1941

| Plot | Dry matter | Protein | Calcium | Phosphorus | Ash |
|---|---|---|---|---|---|
| 1 | 9,980 | 1,303 | 165 | 23 | 619 |
| 2 | 4,900 | 604 | 128 | 7 | 274 |
| 3 | 2,360 | 320 | 66 | 3 | 151 |
| 4 | 2,180 | 287 | 50 | 2 | 126 |

These data show how strikingly the protein yields per acre may be increased by feeding the plant. Plot 1 produced a very high amount of high-quality feed. While this would entail a heavy investment in fertilizer, it would appear as though from a practical standpoint the increased yield would justify consideration of using such amounts of fertilizer. Plot 2, requiring a much lower investment, certainly was highly profitable. Only $11.50 was expended in fertilizers for this plot over a period of three years, but the protein yield was almost doubled over that of plot 3, which received about the average treatment for that district.

Using the current price of oil cake as a base, the values of the protein yields from the respective plots are as follows:

| | |
|---|---|
| Plot 1 | $86.78 |
| " 2 | 40.22 |
| " 3 | 21.31 |
| " 4 | 19.11 |

With the rise in price of protein feeds and the difficulty in securing certain feeds normally used as a source of protein, it is of increasing importance that livestock feeders grow more of their own protein.

The increased phosphate content of the forage due to high phosphate applications should be of very great interest to dairymen, for livestock ills due to phosphate deficiency have been observed over a wide area, and in the great majority of investigated cases soil and crops are found to be abnormally low. True, phosphate can be added to the ration with good results, but this is only a palliative and does not correct the conditions responsible for the deficiency. Until adequate treatment is given to low phosphate soils, crops will suffer in both yield and quality and livestock ills will persist. With the aid of soil and plant tissue tests and with a knowledge of deficiency symptoms in plants, soil management becomes a more simple matter. Hungry plants like hungry animals must be fed.

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# Indiana's Red Gold

(*From page* 20)

correctly gather the fruit. The vines must not be torn or bruised, and only red-ripe tomatoes are picked. Since most of the tomatoes are bought on grade, it is to the growers' best interest to see that they are picked to meet Government U. S. No. 1 standards.

Schools for growers were held in various communities. At these schools soils were tested and analyzed by Purdue specialists so that the correct fertilizers might be recommended. Latest developments in growing and marketing were discussed. Cooperation between grower and canner was stressed so that the entire tomato industry could be knit into one big business.

Once a year graders, too, go through a training school. Each factory buying on grade has a federal grader appointed who checks three hampers picked at random from each load brought to the factory. Payment for the load is made on the basis of the grade of these three hampers. Last year there were 93 federal graders working at Indiana factories.

Normally there are 30,000 people employed in the Indiana tomato industry. A shortage of pickers was expected last season because of the many other jobs available. Everett L. Gardner, Director of Unemployment in Indiana, was appealed to and he promised to rake the highways and byways if necessary to get pickers. But this was unnecessary since itinerant workers turned up from everywhere. In the little town of Hemlock, whose normal population does not exceed 100,

**Peeling and sorting tomatoes at the Kemp Brothers factory, Kempton, Indiana.**

there were quartered 500 Mexican workers, living in any kind of place they could find. Pickers were paid five, six, and seven cents a hamper.

Indiana farmers find tomatoes a good cash crop. In normal years six million dollars are paid to growers. Another six million are paid to labor, and ten million are paid to allied industries, manufacturers of cans, labels, bottles, boxes, etc.

### Certified Seed Used

Tomatoes are usually grown from certified Indiana Baltimore seed which is shipped to Georgia and planted there. When the plants are quite small, they are returned to Indiana farmers. In recent years, direct seeding has been tried and is gaining much favor. Several direct seeders report they have sold enough plants at blocking out, or thinning time, to pay for the seed, labor, and fertilizer.

Very modern methods are used by grower and canner alike. Airplanes are used for dusting the fields, and one factory checked picking operations by plane so they could better gauge the amount of help they would need at the plant the next day.

One group with whom the tomato industry is popular consists of the housewives who live in the small towns where the canning factories are located. Homemaking is the chief interest of these women. Ordinarily they would not think of taking jobs of any kind outside their homes, but when the canning season is on they hurry off in a body, glad to earn the extra dollars which often spell the difference between necessities and luxuries. During the depression those extra dollars frequently meant the difference between living and merely existing. These white-capped, white-gowned women set the social standard in the factory as well as in the town, and woe be unto any canner who, short-handed, may hire outside help of anything less than unimpeachable character.

Probably the most important by-product of the industry is tomato juice. Here Indiana canners surpass all others. It is doubtful if any other commodity has made the rapid rise in popularity that tomato juice has.

As early as 1924 one of the up-state plants was experimenting on the de-

velopment of a palatable juice. In 1927 a French Lick Springs hotel reported to a neighboring canner that their guests were drinking the juice from the canned tomatoes and leaving the solid tomatoes. That manufacturer then began his experiments on juice making. The pale amber, pulpless juice developed as a result of these trials was not looked upon very favorably. It was not until the next year that the homogenizing process, which gives us the non-separating, rich-colored juice we have today, was discovered and patented by Kemp Brothers. Proof that tomato juice is popular is shown by the fact that this factory shipped an entire trainload (59 cars) in one shipment to New York.

The therapeutic value of tomato juice must have been known rather early, for Gene Stratton Porter used tomato juice to cure her hero in the book, "The Keeper of the Bees," published in 1925. (Oh yes, it was tomato juice, even though the movie version did give the credit to orange juice.) Proof of the health-giving qualities of tomato juice is shown by the fact that all baby specialists prescribe it as a first "must-have" for infants. And whoever heard of a child having to be cajoled by a fictitious Popeye into taking his tomato juice? On the contrary, one of the joys of childhood, and one that we never outgrow, is to wander into the tomato patch with a handful of salt to eat our fill of first-quality tomatoes, grown nowhere as fine as in the Hoosier State.

Yes, Indiana is particularly proud of this part of the health- and body-building program she is playing in the Nation's Drive for Victory.

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# Legumes Are Essential to Sound Agriculture

(*From page* 18)

phosphate to alfalfa often is not highly beneficial, it is desirable to apply enough phosphorus at seeding time to carry the crop through its usual period of productivity. Yearly applications of 150 pounds of 20% superphosphate per acre, or 750 pounds for a 5-year period, should be profitable under current conditions. Equivalent quantities of phosphorus in other grades may be used.

Legumes need available potash. Light sandy and gravelly soils are short on potash for legumes unless such land has been liberally manured over a period of years. Unmanured silt loams, also, often respond to potash treatment. And lately, medium-textured soils that have received only moderate applications of manure during recent years have shown good increases in yield as a result of putting on potash. Under present conditions, especially with potash obtainable at very reasonable cost, the use of 100 to 200 pounds of 60% muriate of potash to the acre for such long-lived legumes as alfalfa, ladino clover, and lespedeza sericea should be profitable. If complete fertilizers have been used in fairly liberal amounts and some manure applied, extra potash is less likely to be profitable on medium to heavy soils. For annual and biennial legumes, smaller quantities of potash should serve the purpose.

On light sandy and gravelly soils and on a few heavier ones in the Northeast, alfalfa responds to small applications of boron. Even small amounts of boron may be harmful where it is not deficient. For this reason, it is suggested that borax be withheld until the symptoms have been diagnosed definitely as boron deficiency.

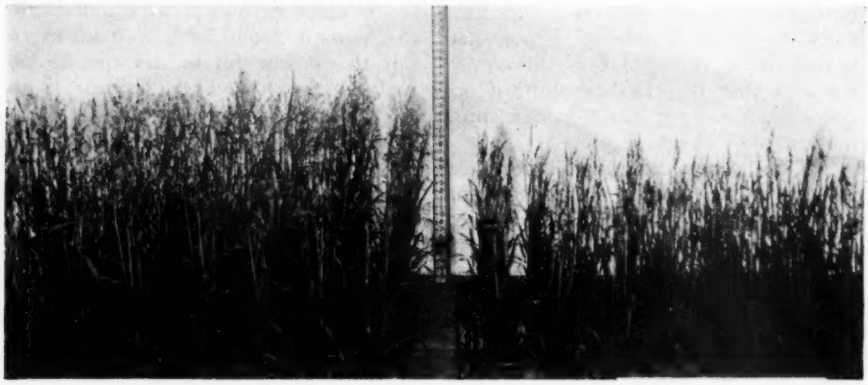
Because alfalfa, ladino clover, and lespedeza sericea are perennials, they should remain productive over a period of four to five years or longer under favorable soil and climatic conditions. The cost of establishing short-lived legumes such as red or alsike clover is approximately the same per

acre as for alfalfa. Red clover produces hay only a single season. The one crop, therefore, must bear the entire cost of establishing it. With the longer-lived legumes, this expenditure is spread over several seasons and constitutes a valid argument in their favor. Furthermore, the rental value and the taxes on land are the same regardless of the size of crop harvested.

Alfalfa, in particular, produces larger yields than red or alsike clover. Corresponding yields in the Northeast are approximately 2½ to 3 tons per acre for alfalfa and 1½ to 2 tons for red and alsike clover under soil conditions favorable for alfalfa.

Legume seed should always be inoculated before sowing it on soil that has not previously produced a successful crop of the particular legume or on soil that does not carry the required bacteria. If several years have elapsed since the legume was grown or if conditions with respect to lime, organic matter, and productivity are not entirely favorable, inoculating the seed before sowing is advised.

Wilson and Leland[1] at the Cornell University Agricultural Experiment Station, reported the yield of inoculated red clover as one-third greater than that of the uninoculated as an average on limed and unlimed soils. Inoculation increased yields of alfalfa one-seventh under similar conditions. In view of the increased yields and the very slight cost, a few cents an acre, of inoculating the seed, the practice is urged for medium- and coarse-textured soils in particular. Conditions for the survival of bacteria in heavy soils seem to be somewhat better than in lighter ones. Nevertheless inoculation is advised until it is definitely determined to be unnecessary with a particular legume on a particular field.



**Oats following clover (left) produced double the yield of oats following timothy (right). Both clover and timothy were harvested for hay and removed from the land.**

Numerous measurements have been made of the quantities of nitrogen per acre fixed by different legumes. Lyon and Bizzell[2] reported that red and alsike clover grown separately fixed 146 and 136 pounds of nitrogen per acre respectively, and even more when grown together. Alfalfa fixed 241 pounds, sweet clover 163, and soybeans 102 pounds per acre annually. As an average of widespread experiments, alfalfa fixed 113 pounds of nitrogen per acre annually, red clover 92 ponnds, soybeans 91, one test each of sweet clover and cowpeas 117 and 86 pounds respectively, and for an average of three separate reports on mixed legumes 112 pounds. This gives a composite, unweighted average of 104

[1] Wilson, J. K. and Leland, E. W., *Jour. Amer. Soc. Agron.*, 21, 574-586, 1929.

[2] Lyon, T. L. and Bizzell, J. A., *Jour. Amer. Soc. Agron.*, 26, 653, 1934.

pounds per acre annually. The perennial legume, alfalfa, fixed most nitrogen; the biennials, red, alsike, and sweet clover, followed closely; and the annual legumes usually fixed least nitrogen.

To supply 104 pounds of nitrogen would require 500 pounds of sulphate of ammonia or 650 pounds of nitrate of soda. Such quantities of nitrogen are important to agriculture and at approximate current prices represent a value of $10 or more per acre in sulphate of ammonia and a still larger amount in nitrate of soda.

If clover and alfalfa hay are fed and the manure is carefully handled, from 20 to 24 pounds of nitrogen for each ton of hay may be returned to the soil. For each ton of timothy fed and the manure similarly returned, the soil loses about 12 pounds of nitrogen. On the basis of about 2½ tons per acre of legume hay and 2 tons of timothy, legumes leave the soil 50 to 60 pounds better off and the timothy 24 pounds worse off. Growing and feeding clover or alfalfa, therefore, leave the soil 74 to 84 pounds of nitrogen per acre better off than if timothy is grown. Careful handling of manure is assumed for both legumes and timothy.

On the basis of the average fixation of 92 pounds of nitrogen per acre by red clover and the fact that a 2-ton yield of timothy takes 50 pounds of nitrogen from the soil, the farm may be regarded as being 142 pounds of nitrogen per acre a year better off after growing clover as compared with growing timothy.

Legumes are useful in seed mixtures for cover crops or green manures. These crops are often grown on soils that have been heavily fertilized, and since they grow over brief periods only, may not fix appreciable quantities of nitrogen. Nevertheless, legumes should be included because the leguminous material, when turned under, tends to activate the nonleguminous green manure and the soil organic matter. In this way legumes are especially useful with coarse crop residues.

If the threatened nitrogen shortage becomes acute, as many think it will over the next few years, legumes can do much to relieve that shortage. Dairy and other livestock and grain farms can obtain most of the nitrogen needed by growing legumes, feeding them to livestock, and conserving the resulting manure and returning it to the soil

**Sweet clover at good stage for plowing under. It has already fixed approximately 150 pounds of nitrogen per acre.**

with minimum losses. Should lack of nitrogen threaten to reduce vegetable and fruit production, manure could be diverted from livestock farms that grow large acreages of legumes for use on fruit and vegetable crops.

Through the use of high-grade legume seed, liberal use of lime if needed, thorough inoculation of the seed, and liberal applications of phosphorus, potash, and trace elements as needed, legumes may be of great service during periods of shortage of nitrogen in the present emergency and in the agricultural depression that usually comes a few years after a war.

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# "Civ-ense"

(*From page* 5)

ense boys into giving him the post, which, he said, tallied with the national slogan because he intends to make everybody get "all out"—all outdoors. Staying inside and mooning around the radio for the latest war scare or vitiating ourselves in closed rooms with atlases in his opinion stifles the supreme sacrifice we ought to be able to meet. His main campaign will be centered on what he calls "Tire-less Hikes," a regimen intended to regiment us into calm nonchalance over Henderson's rubber edict. It doesn't look so good for gardening this summer, what with Abel's sleepless nights and Nobby's tireless days. What the enemy can't think up to discommode us, our loyal leaders will. But we can at least thank our unlucky stars that Nobby hasn't planned to lead us into badminton.

Finally, only yesterday I had picked me out a profession and had raised my hand to take the oath as Ward Case Worker, when the Civense secretary asked me if I really knew what it was all about. I replied urbanely that my long experience during numerous humid summers ordering and emptying countless cases to refresh my friends should indeed make me an adept at this entertaining diversion, one which, I further stated, would be found handy as an antidote to war's alarms. When they told me that it meant butting into other folks' homes to find out why some feeble-minded provider wasn't buying the groceries, I shuddered at the brink I had almost dashed into.

Feeling sorry for me in this dilemma, one board member sought to cover my confusion by suggesting that the most vital staff office of all remained unfilled. Whereupon he tendered me the post of Recruiting Officer, and asked me to extend myself widely soliciting volunteers for everything and anything in the Civense career field from Accountant to Zither Player. He astonished me with the news that our township quota remained woefuly unfilled and away below patriotic par. This in spite of the calamity of Pearl Harbor. His caustic comment may have been undeserved when he said, "It's like casting Pearls before Swine, the indifference we encounter."

But I soon discovered for myself that the tire office was under constant siege while the Civense department next door was almost as lonesome as an auto salesroom. Evidently the Abels and Mirandas deserved more credit than our neighborhood bestowed on them. Working for America for nothing and paying your own expenses hasn't come first in the hearts of our countrymen. But if slogans won't do it maybe the slugs will later on.

Consequently, I'm finding it harder to get other folks to join than it was to land a soft berth myself in the Civense circle. You can easily secure emotional zealots on the verge of paranoia or dementia praecox who couldn't be trusted to wield any implement or weapon more rugged than a sofa pillow. You can find volunteers readily among the professional lodge and parade

brothers, owing to the glamour and regalia they look for in any organized defense. But what we need are genuine hard-working citizens, realistic and healthy, sensitive without being squeamish, who are aware that a total war may jump right into their own back yard all the way from Burma.

Cynics and detractors may find nevertheless that many of our citizens who are backward about coming forward at the dress rehearsal may be depended upon for action when the enemy bombers cross the border. The only bad feature of this delayed action is the penalty we must pay for resulting confusion and frenzy. There's a lot we ordinary non-technical fellows don't know about meeting emergencies, and the longer we wait for somebody else to take the initiative, the better the chance for the Japs to toss some of our old scrap-iron through our church and library roofs.

IF, as we hope and trust, the armed forces resist the onslaught before we are imperiled at home, there remains the maintenance of courage, faith, and loyalty for the Civense units to foster. Maybe, after all, these are the real elements which make a country internally resolute and steadfast. Thus it becomes more vital to insulate ourselves from our own weak cussedness than to isolate ourselves from conquest.

Since assuming the recruiting job, I have heard nasty cracks jibed at the rural populace by some solicitors who claim the farmers are not signing up for anything, not even defense bonds. I merely tell them that farmers are so busy figuring out ways and means to plant the crops and make the hay next summer with a few city high school lads and volunteer farmerettes to help them that they can't put their minds to Civense duties. One farmer told me, however, that he had a choice Civense job planned for his hired man, who, he thought, would make a right smart airplane spotter on account of his being flat on his back so often on bright days in summer. But he withdrew that application just as soon as I reminded him that a spotter is obliged to rush off and report the tidings by 'phone. He said the only way he could think of to make it work would be to keep the telephone on the dinner table and keep the table well loaded.

After some deep pondering I have deduced the idea that maybe our Civense program resembles the old fable of the boy who didn't budge when the fellows who had been fooling him so often finally discovered a big, bad wolf in the offing. That is, I wonder if we haven't been subjected to a continuous series of emergencies, big and little, real and imaginary. I wonder if those impulses begotten by emergency campaigns have perhaps begun to peter out. I know it's a completely different kind of emergency and the repercussions from it will be more than big words out of a dictionary, and that partisanship and pettiness ought to be buried deep and be left without a headstone.

OUR economic campaigns and our political campaigns too often have been sandwiched together and taken in one gulp. Now we face a terrific reality and lack the stomach or the appetite to swallow it. I'm confident we will recover our zest and begin to caper around again after this little bilious attack from an overdose of emergencies has subsided.

However, I am mighty glad to report that we still have our doughty Abels and Mirandas willing to forget and forgive any and all former mistakes of administrative ardor; and who have girded their loins with overalls and tweed skirt to work humbly among the rank and file who stand in need of training, shelter, and sustenance.

When my recruiting task is finished and abler folks than myself are engaged in protective efforts in our modest district, I can at least snatch at the first alphabetical post on the rural roster and go forth serene and sweaty to last as long as I can on a July day in the imperative duty nature assigns me—Alfalfa Pitcher!

### In Some Cases

The teacher was explaining to her class what was meant by "bigamy."

"It means," she said, "having two wives at one time. Now, can any boy tell me what word means having only one wife?"

"I can, teacher," said one boy; "monotony."

---

Mrs. Malone: "What did your uncle die of, Mrs. Flanagan?"

Mrs. Flanagan: "Gangrene it was Mrs. Malone."

Mrs. Malone: "Thank hivins for the color, anyway, Mrs. Flanagan."

---

Two fussy traveling salesladies were riding in opposite seats in the train. One thought the car was too hot, the other said it was too cold.

Just then a dusky porter came through.

"Porter," commanded the first lady, "I wish you'd open that window. I'm nearly smothered."

"Don't you do it!" snapped the other. "If you do I'll freeze to death."

The porter scratched his head.

"What you 'spose Ah should do in a case lahk dat?" he asked a portly-looking traveling man, about two seats to the rear, trying to enjoy a little reading.

"Open it a while and freeze one; then shut it and smother the other."

---

Drunk: "Didjoo shee me come in?"

Desk Clerk: "Yes."

Drunk: "Didjoo ever see me before?"

Desk Clerk: "No."

Drunk: "Then how'd you know 'twush me?"

A young man and his fiancee had wed and were spending their honeymoon at a large hotel. When bedtime came the bride went to bed and the groom sat by the window and gazed at the moon and stars. The bride called to him and asked: "Why don't you come to bed?"

He replied: "My mother told me my wedding night would be the most beautiful night of my life, and I'm not going to miss a minute of it."

---

She: "I walked three miles last night."

He: "For goodness sakes?"

She: "For what other reason, I'd like to know."

---

The hillbilly boy walked into the town confectionery and asked for an ice cream soda. The clerk presented the drink, all done up with a cherry and two straws. After a few minutes, the boy called the clerk and said, "Mind ef I take them holler sticks out? They keep a-knockin' my hat off."

---

### Bye Now

Doctor—"Nurse, you've been with that handsome patient in 408 over an hour."

Nurse—"Don't stop me now. I've got to get a thermometer."

Doctor—"Gosh, is he running a temperature?"

Nurse—"No, but I am."

---

"You've left off your medals," snapped the Captain.

The man looked down at his chest. "Great Scott!" he cried, "I forgot to take them off my pajamas."

# CONSERVE THE NATION'S SEED SUPPLY

## WITH

# Spergon

★ ★ ★ ★ ★ ★

***In 13 Significant Pea Seed Treatment Tests the Average Stand for Untreated Seed was 52%—Seed Treated with Spergon was 82%***

For the complete facts and figures we refer you to the Pea Seed Treatment portion of report of the Coordination in Seed Treatment Research Committee, American Phytopathological Society, given Dec. 31, 1941, at Dallas, Texas.

From these impartial Experiment Station tests it would seem that Spergon exceeds even our own claims for it . . . which are as follows:

★ ★ ★ ★ ★ ★

**1. EASIER.** One chemical treats vegetables and flower seeds.

**2. SAFER.** Widespread experiments indicate Spergon is harmless to delicate seeds and plants, including peas and beans (notably LIMAS). Safer for people too: Spergon is a true *organic* chemical, containing no poisonous metallic substances.

**3. WORKS IN ANY TYPE OF SOIL.** Contains a powerful "buffer" against the weakening effect of soil chemicals.

**4. SURER.** Better protection against "damping-off" and seed decay. Attacks both seed-borne and soil-borne fungi harmful to germination.

**5. SELF-LUBRICATING.** On peas, for example, no graphite is needed to help seed through the drill.

**6. LONGER-LASTING.** A very fine powder with unusual adhering power — coats seeds evenly, completely, lastingly. So stable, seeds can be treated months before planting.

**7. COMPATIBILITY WITH INOCULATION.** Legume Bacteria may be used with Spergon-treated seed with benefits from both treatments.

**8. ECONOMICAL.** Assurance of high yield pays for treatment many times over.

**TYPICAL DOSAGES:**

| | |
|---|---|
| Corn | 1½ oz. Spergon per bu. seed |
| Peas | 2 " " " " " |
| Beans | 2 " " " " " |
| Sugar Beet | 3 " " " " " |
| Lettuce | 6 " " " " " |
| Spinach | 4 " " " " " |
| Melons | 3 " " " " " |

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**UNITED STATES RUBBER COMPANY**

NAUGATUCK CHEMICAL DIVISION
1230 Sixth Ave, New York, N.Y.

# FERTILIZER *Films* AVAILABLE

WE shall be pleased to loan to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations and members of the fertilizer trade, films bearing on the proper use of fertilizers, particularly potash. Anyone interested in showing these films should direct his requests to our Washington office.

### Potash Production in America

Shows the location and formation of American deposits and scenes of mining and refining of potash in California and New Mexico.

16 mm.—silent, color—running time 40 min. (on 400 ft. reels).

### Potash in Southern Agriculture

Covers fertilization and potash deficiency symptoms of cotton, tobacco, and corn at several Experiment Stations in the South, also crops in the field, fertilizer placement work, and scenes in a fertilizer factory.

16 mm.—sound, color—running time 20 min. (on 800 ft. reel).

### Bringing Citrus Quality to Market

Shows influence of fertilizers, particularly potash, on yield and thickness of rind, volume of juice, weight, and general appearance of citrus fruit.

16 mm.—silent, color—running time 25 min. (on 800 ft. reel).

### New Soils From Old

Experimental work on Illinois Soil Experiment Fields and the benefits from a balanced soil fertility program using limestone, phosphates, and potash in growing corn, wheat, clover, and other crops.

16 mm.—silent, color—800 ft. edition running time 25 min.; 1,200 ft. edition running time 45 min. (on 400 ft. reels).

### In The Clover

Depicts the value, uses, and fertilizer requirements of Ladino clover in Northeastern agriculture.

16 mm.—silent, color—running time 45 min. (on 400 ft. reels).

### Ladino Clover Pastures

Determining proper fertilization of Ladino Clover for best utilization as pasture for livestock and poultry in California.

16 mm.—silent, color—running time 25 min. (on 400 ft. reels).

### Potash Deficiency in Grapes and Prunes

Effects of potash deficiency and fertilizer treatments on grapes and prunes in California.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

### Machine Placement of Fertilizer

Methods of applying fertilizer to California orchards, lettuce, and sugar beets with various types of apparatus devised by growers.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

### Potash From Soil to Plant

Sampling and testing soils by Neubauer method to determine fertilizer needs and effects of potash on Ladino clover in California.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Requests for these films *well in advance* should include information as to group before which they are to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

**AMERICAN POTASH INSTITUTE, INC.**

**1155 Sixteenth Street** **Washington, D. C.**

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